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SELECTIONS

IN

PATHOLOGY AND SURGERY;

OR,

AN EXPOSITION OF THE NATURE AND TREATMENT OF LOCAL DISEASE;

EXHIBITING

NEW PATHOLOGICAL VIEWS,

AND POINTING OUT AN

IMPORTANT PRACTICAL IMPROVEMENT.

ILLUSTRATED BY CASES.

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TO THE GOVERNORS

OF THE

GENERAL INFIRMARY AT HERTFORD,

THIS WORK

IS INSCRIBED, WITH EVERY SENTIMENT

OF RESPECT, BY THEIR VERY OBEDIENT SERVANT,

THE AUTHOR.

Hertford, June 20th, 1839.

PREFACE.

The author hopes that he will not be considered as arrogating too much in claiming the character of novelty to the pathological views promulgated in the present work. If, however, it should be pointed out, by those more extensively acquainted than himself with medical literature, that similar views have been already made known, he will readily relinquish all claim to originality.

The physiological principles upon which the pathology of inflammation here set forth is based, were published eleven years ago, in a series of essays in the Medical Repository, and the London Medical and Surgical Journal, of which the author was then editor. The principles developed in those essays are founded upon a long course of experiments, repeated so frequently as to leave little doubt as to their correctness.

The object of the second part of the work is to bring into general notice a remedy whose superior curative properties, as an external application, appears to be but little known to the profession. This remedy is iodine in liquid form. Respecting the employment of iodine as an external remedial agent, the author lays no claim to originality; but, with the exception of a small volume, published some years ago, by Mr. Buchanan, he is not aware that the mode here recommended for its application has been pointed out to the public. During the last ten years the author has employed the remedy in question very extensively, both in infirmary and private practice, and the object of the present work is to acquaint the profession with the result of his experience respecting its use during that period.

Being very desirous that a knowledge of the curative properties of iodine, as an external agent, should be diffused as extensively as possible amongst the members of the profession, the author has caused the second part of the work to be published in a separate volume.

PART I.

LOCAL PATHOLOGY.

INFLAMMATION.

According to the pathology of the present day, the term "inflammation" is applied to almost every disease to which the human body is subject. The consequence of this view of the nature of disease is, that inflammation has been divided into numberless varieties, and scarcely any two authors agree respecting the manner in which the divisions ought to be made. Thus, according to some, we have the *acute* and the *sub-acute* or *chronic:* others furnish us with the *adhesive*, the *suppurative*, and the *ulcerative:* others divide the disease according to its immediate seat, or to the tissue which is affected; while others again classify it according to its tendency to spread, or to confine itself to a limited space. The dispute in every instance is, not whether the disease be *inflammation* or not, but whether it ought to be classified under one head or under another.

With regard to the proximate cause of inflammation, pathologists have been equally at variance in opinion. It has been attributed to *error loci* of certain particles of the blood; to the existence of irritating or acrid matter in some of the humours; to the viscidity of the blood itself, thereby causing *lentor* in its movement through the vessels; while most of the pathologists of the present day discard all notion of the blood having any thing to do with the causation of the disease, and seek for the origin of the malady in the solids alone. By some of them it is attributed to an *increased action* of the arteries of the inflamed part; by others to a *diminished* action; by others to an increased action of the capillaries, thereby causing them to attract more blood to the seat of disease than naturally belongs to it; whereas others again attribute all the mischief to irritation in the extremities of the nerves. In fact, the theories of inflammation are as various as the aspects which the disease presents to the senses of the observer.

Notwithstanding all the theories that have been advanced respecting the nature or proximate cause of inflammation, all must agree, that the visible and tangible signs of it depend upon the condition

of the arteries of the inflamed part, and upon the modification of the circulation of the blood within them. Taking these facts as the groundwork of the enquiry, we shall proceed to examine what this condition really consists in; we may then be able to assign some rational or probable cause for the *inflammatory* appearance put on by so many diseases, possessing in all other respects such various properties, and leading to consequences so different in their nature. First, however, as our views differ essentially respecting the *natural functions* of the vessels principally engaged in the representation of the more striking phenomena of inflammation, from those of any author with whose works we are acquainted, it is necessary to say a few words upon that subject.

A view of the Mechanism and Structure of the Blood-vessels.[1]

The apparatus which conduces to carry on the circulation of the blood consists of a forcing machine, to which is attached an elastic tube, which tube divides and sub-divides into innumerable ramifications. These ramifications unite into larger branches, which branches again unite into larger and larger tubes, until, lastly, they form only two trunks which deliver the blood back to the machine from which it originally started.

We are first to notice the peculiar texture of the heart. This organ differs in respect to texture from all the other muscles. It is remarkably dense; its fibres are firmly bound together by transverse striae, and, compared with the other muscles of the body, very little cellular membrane intervenes between these fibres. This modification of structure indicates considerable strength, but with a limited scope of motion; for we find those muscles whose sphere of motion is extensive, imbedded in proportionately a large quantity of cellular tissue.

The texture of the arteries is also peculiar, but it is well adapted for the functions which they have to perform. Very erroneous notions respecting the muscularity of these vessels have been entertained by authors and by anatomists generally. In order to be able to determine this point, it is necessary to define what are meant by muscular fibres.

It must be admitted that a muscle, like all other bodies, has certain distinct characters which determine it to be what it is. It is composed of a greater or less number of elastic fibres, placed parallel to each other; and these fibres are bound together, at intervals, by striae or smaller fibres, each being separated from the rest by a very small portion of cobweb-like tissue. The primitive

[1] This subject has been treated at length, in a series of essays published by the author, in the Medical Repository for 1827 and 1828, of which he was then editor. Only a short sketch of the experiments and deductions therein given can be adduced here.

or simple fibres are gathered together into fasciculi or small bundles, surrounding each of which there is a larger quantity of cellular tissue than is found around every simple fibre. The muscle is composed of a number of these fasciculi or compound fibres, and, like them, the whole body of it is invested in a coat of cellular tissue. This is the character of muscular structure.

Now, the next question is, do we find any thing in the coats of the arteries corresponding with the above definition? We presume not; that is, we presume so upon a very strict examination of their structure.

Including the external coat, which is composed of condensed cellular membrane, an artery is made up of three layers or coats. The innermost layer, which, on one side, presents a polished surface for the blood to move on, is formed of a highly elastic tissue, but nothing like muscular fibres are discoverable in it. The next layer is also considerably elastic, but less so than the innermost coat. This being the coat usually considered muscular, we have paid much attention to its structure; but upon the minutest examination, nothing could be discovered in its texture to correspond with the fibres of muscle. The mistake may have occurred from considering the fibrous processes, which unite it to the outermost coat, as muscular fibres; for, with the exception of these, scarcely any tissue in the body presents less the appearance of muscle. The outermost layer is likewise elastic, but its elasticity is inferior even to that of the middle coat, though its toughness considerably exceeds that of the latter.

An artery, thus composed of its different layers of coats, is elastic to a considerable degree; but the elasticity does not depend upon muscular fibres. Indeed, such a structure, as will be pointed out hereafter, would be inconsistent with the functions which these vessels are destined to perform in the animal economy. It may be noticed that the elasticity of the arteries is somewhat greater in the longitudinal than in the circular or transverse direction.

With regard to the veins, they have been deemed almost unworthy of notice by authors. It is true that, in a *surgical* point of view, they are less important than the arteries, but, *physiologically* considered, they are scarcely so.

Although the veins are greatly more elastic than the arteries, yet few, if any, anatomists have attributed *their* elasticity to muscular fibres. The range of calibre in this class of vessels is very considerable; and it may be remarked that their elasticity is much greater in the transverse or circular direction than in the longitudinal. This quality is different in them, in that respect, from what it is in the arteries, whose range of calibre is not, upon the whole, very extensive, compared with that of some other elastic tissues.

As this subject is of considerable importance towards a right understanding of the functions of the blood-vessels, we may be allowed to offer a few more remarks upon it.

In the human body, as well as in the bodies of all the higher classes of animals, we find that a considerable part of the structure is endued with the property of elasticity. Thus, the voluntary muscles, for the most part, are highly elastic; so are all the organs of which the alimentary tube is composed; so are, likewise, the urinary and the gall bladders; the uterus is endued with the same property in a different modification; the arteries and the veins; the lacteal tubes and the thoracic duct, as well as the ducts of the secretory glands, &c. are all possessed of an analogous property; but it differs in degree and modification in each organ, according to the duty—according to the extent of motion—which the organ has to perform. Thus, in the voluntary muscles, it enables them to shorten themselves from one third to one half their natural length; whereas, the stomach, the urinary bladder, &c. possess a scope of motion ten times as great. In the small intestines the scope is less than in the urinary bladder; the veins possess the elastic property still less than the small intestines, and the arteries less than the veins.

Now, we find here a general analogy in a number of organs, but each presents a modification peculiar to itself, and which qualifies it for its own particular function. It is characteristic of a muscle to contract in one direction only, that is, in the direction of its fibres, because its ultimate object, with the exception of the sphincters, the heart, and a few others, is not so much to undergo motion itself as to move other parts to which it is attached. On the other hand, the urinary bladder will contract almost equally in all directions. In this respect it differs essentially from muscle; for the latter will only display its elastic property in one direction. It cannot be said that the sphincters, the heart, the pharyngeal muscles, &c. are exceptions to the rule, for we find no instance of muscular motion otherwise than in the direction of the fibres of the moving muscle. Again, the motion—accordingly the elastic property—in the small intestines is both in the longitudinal and circular directions, but much greater in the former than in the latter; whereas in the colon and rectum the reverse is the case. The arteries, being situated so near the bones, and consequently being liable to great and *sudden* extension, by the movements of joints, are very yielding longitudinally; whereas, although elastic to a considerable degree in the circular direction, yet much more power is required to force their extension in the latter than in the former direction. The veins are equally elastic with the arteries longitudinally, and are fully capable of following the motions of joints without the risk of being ruptured; but as, in the due performance of their peculiar office, they are required to undergo a ready and rapid change of calibre, their elastic property in the direction of their circle exceeds that of their longitudinal direction.

Having exhibited this view of the structure of the blood-vessels, we shall next proceed to a short examination of the functions which their different parts have, each, to perform.

On the Functions of the Blood-vessels.

Any one who will take the trouble to examine the action of the heart in a living animal will be satisfied that, during its contraction, the fibres are drawn *below* the medium of their elasticity. The contraction is *active ;* but the dilatation of the cavities is *passive*, depending simply upon the elasticity of the structure of the organ. If the heart be taken out and placed on the hand before its action has ceased, and then if the hand be gently closed round it, every time the ventricles contract, the organ will be felt to exert considerable force : it will be felt to swell and harden, and to cause a good deal of pressure against the hand ; but, during the dilatation of its cavities, it will be felt merely to *relax* its fibres, without any active force.

The idea obtained by means of the sense of touch respecting the nature of the heart's action is fully confirmed by that of vision. When viewed in active operation, and regularly supplied with blood, its contraction will be seen to take place in a very quick and sudden manner, whereas its dilatation appears quite passive, and it takes a much longer time to be accomplished. Again, when viewed in action, *not* supplied with blood, that is, when the organ has been removed from the body, or when the blood has been allowed to escape through a puncture of one of the principal vessels, the contraction will be seen to consist in an *active jerk*, and to be over in an instant ; whereas the motion which corresponds to the dilatation of the ventricles, when the viscus is regularly supplied with blood, will consist comparatively of a slow and gradual *elongation* of the fibres ; which fully satisfies the mind that it depends merely upon these fibres recovering the medium of their elasticity, after having been compelled by some previous cause to contract themselves below that medium.

It may, perhaps, be asked, by what power are the muscular fibres of the heart enabled to shorten themselves below that medium which characterises them as an elastic substance ? In explanation of this point we must be permitted to offer a few remarks, which may not, perhaps, be generally considered to pertain to the *practical* part of the subject, but which are essential towards acquiring a rational idea of the pathology of inflammation.

Every organ, and even every tissue, in the animal body must be viewed, physiologically, in two conditions : first, as composed of material molecules which contribute to make up the structure, and which, according to their proportions in the different organs, are endued with all the properties of matter in general, and are subject to all the laws which govern the material world : second, as parts endowed with something in addition to the common properties of tangible matter, which *something*[1] confers upon them the character

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[1] This subject is discussed at great length in the essays to which reference has been already made.

of vitality. It is unnecessary, in this place, to enter into an enquiry of all the properties which distinguish animate from inanimate matter : it is sufficient for our present purpose to state generally, that those properties and those functions or effects only are to be attributed to life which an organ is capable of manifesting in a living state, and which it is not capable of exhibiting in the state of death. Thus, the liver, as a material organ, is as perfect for some time after death as before, yet blood may be forced through it in vain, so far as the secretion of bile is concerned. The dead stomach is equally insensible to the presence of food ; nor will the dead kidney show any disposition to secrete urine, though fresh blood be injected into it. It is true that a muscle which has been attached to two or more points during life will contract, when liberated, even after death ; but it accomplishes this effect by a property connected with its material structure, and which is equally manifested by Indian rubber and other inanimate substances endued with the quality of elasticity. The phenomenon of contraction in a living muscle is very different from that exhibited by the same muscle in an inanimate state. Nature, by her laws, has destined all things to be as they are. We may examine their properties, we may compare the properties of one substance with those of others, and observe what each substance is capable of doing, so far as our senses furnish us with the means of so doing, but if we attempt to search into the *why* and the *wherefore* they have the power of doing what they do, our curiosity will be very likely to meet with disappointment.

Now, to return from this apparent digression, we may state that the medium of elasticity of the heart is at that point where the fibres rest quiescent after death. That point corresponds to the state of expansion or extension of its cavities during life. The contraction of the organ is caused by its *vital* principle ; it is a *vital* operation, acting for a very short period of time before resuming a state of repose. During the cessation of the *vital* energy, the *elastic* force of the fibres comes into play. As soon as this latter has accomplished its part, and has restored the muscular fibres to the point where resides their medium of elasticity as material substances, the vital force is repeated, and it acts again upon the muscle as pressure would upon any elastic body. This active, vital contraction, and passive, elastic dilatation or extension of the muscular tissue, go on alternately, both in the auricles and ventricles ; and when the ventricle undergoes the one kind of motion the auricle undergoes the other, and *vice versâ*.

It follows from these facts, of which any one may satisfy himself by minute and accurate examination, that the *vital contractility* of the heart is a power opposed to its innate *elasticity*. The force of the former is very considerable, as may be felt by pressing the organ in the hand. Its duration is only momentary. It appears to be over as suddenly when the organ is on the point of death as when it acts in full vigour on being first exposed to view. After

death the organ rests in the state of expansion—that state into which
it has been brought by its elastic property.

That the heart propels the blood into the arteries by the contrac-
tion of its ventricles, is a fact in physiology generally admitted;
but it has been, and is still, a very disputed question as to whether
the power of the heart be the sole cause of the motion of the fluid
throughout the circulating system. We shall first enquire what
share, if any, the arteries perform in the office of circulation.

Without re-describing experiments already published more than
ten years ago, we may be allowed to state generally, that the coats
of the arteries *do not undergo any sensible motion* during the cir-
culation of the blood. We have repeated experiments upon ex-
periments respecting this point, and the result was a conviction
that, with the exception, in some instances, of a small portion of
the root of the aorta, *the arteries are mere passive tubes* in the
office of circulation. Having made this general declaration, it may
be necessary to reconcile some known facts with the statement so
unhesitatingly expressed.

It will, perhaps, be asked, if the arteries merely supply passive
channels for the motion of the blood, how can the " pulse" be ac-
counted for? Do we not *feel* the artery beat on placing the finger
on it? Nay, do we not sometimes *see* it pulsate through the skin—
that is, *see* the skin move over it? Do we not, when sitting cross
legged, often see the pendent foot move simultaneously with the
pulse, in consequence of the beating of the popliteal artery? These
and other similar questions will be asked by those who have taken
it for granted that the arteries contribute an important share in for-
warding the motion of the blood. But all these facts are easily ac-
counted for without supposing the vessels to perform any move-
ment like that of the pulse. They occur from the following cause:
the arteries are *always full* of blood. Every contraction of the
left ventricle drives the column a step forward. The motion may
be compared to that of a rod pushed forward from one end; but in-
stead of being solid like a rod, the column of blood is *fluid*, and
contained within an *elastic* tube. The blood being fluid, and the
containing tube being soft and elastic, almost any degree of pres-
sure, however slight, on the artery will cause a depression or in-
dentation of its coats; and as the contractions of the heart cause
the blood to be driven forward with great power, the column ex-
erts a force, at each contraction, to raise the indentation or de-
pressed portion of the coats of the vessel.

In like manner, in cases where the skin is seen to pulsate over
an artery, the pulsation is caused by the tightness of the skin in
that part, owing to the position of the limb at the time. If the ves-
sel which, in such a case, produces the motion or pulsation of the
skin, were laid bare, which would, of course, cause the removal of
the pressure on its coats, not the slightest pulsation could be dis-
covered in it. In a similar way, the pulsation of the pendent foot

when one is sitting cross-legged, is occasioned by the pressure of
the knee of the corresponding limb on the popliteal artery.

If an artery be laid bare, and the finger be placed *very lightly*
upon it, no pulsation will be felt; and to the sight the vessel will
present an unmoving cord. Even a powerful lens will not enable
us to discover any pulsation in it. Also, in some very thin per-
sons, the principal arteries of the arm exhibit a thick cord through
the skin; and, in these cases, if the finger be laid very lightly on
the vessel no pulsation will be felt; but the slightest pressure on
its coats will cause an indentation or depression, and will immedi-
ately communicate the sensation of pulsation to the finger.

The importance of this subject entitles it to more consideration
than can be bestowed upon it according to the confined limits
marked out for this work; but we may, in passing, notice, that no
property usually attributed by physiologists to the coats of the ar-
teries would enable them to render any assistance to the heart in
the propulsion of the blood. Now, let us just consider two points,
respecting which no small degree of error exists.

In the first place, it is maintained by some authors, that the ar-
teries are always in a state of "forced distention," that, in fact, the
blood within forces them to expand beyond their medium of elasti-
city. If such were the case, it is difficult to conceive in what way
they could render any assistance to the heart; for not only would
that organ have then to move forward the whole weight of the
column of blood, but it would also be required to *force* the expan-
sion of the arteries. What else than the power of the heart, driv-
ing the fluid into them, could force them to expand? It may be
further demanded, what benefit could result from such a state of
things? Nature does not often, probably never, create an useless
obstruction merely for the sake of showing her capability of crea-
ting a force strong enough to overcome it.

Secondly, it is a common error to suppose, not only that the
arteries pulsate independently of the heart, but also that their pul-
sations may be slower or quicker than those of that organ. That
a subject so easily put to the proof should have been so long allow-
ed to remain a source of error, does not argue much in favour of
the industry of physiological writers. It causes some trouble to
satisfy one's self upon points requiring a series of experiments on
animals, but it is less pardonable to propagate error respecting a
subject which any one may prove without even quitting his easy
chair.

The pulse will often vary in the number of beats in a given time.
One minute it may beat 85, and the next it may beat 87 or 88, or
perhaps only 82 or 83. But is this any proof that it depends upon
the action of the arteries? If the pulsation of the heart itself be
examined, it will be found to vary quite as much as that felt in the
arteries. The fact is, *that the pulse or beat is felt in every part
of the arterial system at the very same instant of time, and that*

instant of time is the same as that in which the ventricles of the heart contract.

The only way in which the arteries could assist in propelling the blood forward, so as to aid the heart, would be by a series of contractions and dilatations following one another along the course of the tubes. If the vessels possessed such a power, then we might expect the pulse to vary in different parts of the body, nay, in different parts of the same tube; for while one part was in a state of contraction, another, two inches above, would be in a state of dilatation, and so on throughout the whole course of the tube. In the alimentary canal, especially the large intestines, such a motion may be observed to be continually going forward. In fact, there exists no other power for the propulsion of the fæces. In the arteries, however, the fact is equally certain that no such motion exists, but that an exposed artery will present to the eye the appearance of an immovable cord.

Having established these preliminary facts respecting the state of the heart and arteries during the natural and unobstructed circulation, we next come to that part of the subject upon which mainly rests our new views respecting the pathology of inflammation. We shall, therefore, place the statement before the reader under two heads:

1st. The only motion which the arteries undergo is that of *gradual* contraction, and of *gradual* dilatation, so as to adapt themselves to the quantity of blood within them;

2d. The calibre of all the arterial branches, during life, and in a healthy state, is *below* the medium of their elasticity.

The overlooking or being ignorant of these two facts have led pathologists into endless absurdities respecting the pathology of inflammation; at any rate, respecting the theory of the phenomena presented by it.

Now, during life and health *the blood-vessels are always full of blood.* Whatever artery or vein we examine it will never be found empty. It is true that the vessel is sometimes remarkably small in proportion to what it is found at other times, or to the corresponding vessel of another person; yet, still, when examined it will prove to be, according to its size, full of fluid.

For instance, the superficial veins of the arm are sometimes so small as to render it difficult to puncture them with the lancet; whereas at other times they show themselves in the form of thick blue ropes. But however small they may be they always preserve their cylindrical form; and though sometimes not so large as a crow-quill, yet if punctured they will be found full of blood. The veins on the back of the hand will occasionally present very prominent cords when the member is allowed to hang down. While in this state, if the hand be raised above the level of the heart, so as to allow the fluid to gravitate towards that organ, the veins will be found to diminish immediately in size; but the diminution will not be owing to their falling into a *flat shape*, as we see them after

death, for they will still present the cylindrical form, though the cylinders will be very small compared with their former size.

The venous system is subject to this constant change of calibre in its several parts; its power of adaptation, therefore, to the size of the column of blood within is very great. When the calibre of one part of it diminishes, that of some other part must necessarily increase in proportion, so as to make up for the diminution. These vessels are, of course, well adapted for the sudden changes which take place in them. Their structure is considerably more yielding than that of the arteries, yet it is sufficiently dense to enable them, when endowed with vitality, to preserve their cylindrical form under the ordinary pressure of the atmosphere.

Now, we find this principle considerably modified in the coats of the arteries. The object of the veins is simply to return the blood to the heart; and whether more or less of it moves through one channel than another—whether a larger or a less proportion finds its passage through the superficial, or the deep seated veins—is perfectly immaterial, so long as the right side of the heart receives its regular supply. In the arteries the case is different. Every branch of an artery conveys nourishment to some seat or other. Every twig is charged with the conveyance of all the materials requisite for the nutrition, secretion, and other functions connected with the seat which it goes to supply. This being the case, although the stoppage of the blood through a branch of an artery is not fatal to the part which it supplies, for nature has provided other means of conveying nutriment to it, still a limb would suffer great evil if changes in the calibre of its arteries were to take place so frequently and so suddenly as they do in its veins. When an artery of some size is obstructed, it is well known that some time must elapse before the limb which it supplies recovers its natural warmth and healthy condition.

It is therefore reasonable to expect that the arteries would be less liable to a sudden and rapid change of calibre than the veins. In truth such is the case. The ordinary change which the arteries undergo is the following: supposing the body to contain twenty pounds of blood: the arteries will be perfectly full—that is, every part of their inner coat will be in contact with the column of blood within: we abstract *one* pound of blood; the arteries will still be as *full* as before: we abstract *two* pounds more: yet not a portion —not a quarter of an inch—of the arterial tubes will be empty: we go on abstracting more and more; nevertheless, if we examine any part of the arterial system, we shall find the vessels perfectly full, until the animal be actually dead from loss of blood. The vessels adapt themselves to the column of blood within them; and as the diameter of that column is reduced by abstraction, the diameter of the vessel also which contains it diminishes in the same proportion.

On the other hand, as the mass of blood in the system undergoes an increase, the arteries will gradually enlarge, so as to allow it

sufficient space. They will not be in a state of forced distention, for the pressure of their contents will not be greater than if the fluid column were only half the diameter. The relation between the coats of the vessels and the blood will be the same whether the system contains forty pounds, or twenty.

This property of the arteries we have proved, beyond the power of dispute, by repeated experiments. By a series of bleedings, at short intervals, allowing just time enough between them for the circulation to recover its equilibrium, the blood-vessels may be reduced to so small a calibre as almost to render their canals impervious. This fact is so well known to butchers that their practice is entirely founded upon it in their mode of killing veal. By repeated bleedings and starvation, for two or three days, almost every drop of blood may be abstracted from the animal at the *last* bleeding, and the flesh will be left bleached. When an animal is bled to death at once, life ceases to exist before the vessels have had time to adapt themselves to their contents. The disturbance is so sudden and so great that the inherent powers of all the organs are destroyed; and, after a certain quantity of the vital fluid has escaped, death ensues, leaving still a considerable portion of blood in the system. On the contrary, when intervals are left between the bleeding, so as to enable the vessels to modify their calibre, and suit themselves to their new relations, the animal will live with a very small portion of blood in its body.

Then comes the enquiry, upon what does this remarkable property of the blood-vessels depend? Does it depend upon the innate elasticity of their coats? The answer must be in the negative; for if the animal were bled to death at once, the circumference of the arteries would be found much greater after the cessation of life than it was immediately before death, when the blood has been abstracted by repeated bleedings. We must therefore seek for the cause of the property in something not essential to the vessels as mere material tubes. In a word, this property of contractility is conferred upon them by the principle of life, which resides in their coats and which regulates their functions as vital agents:

We have already alluded to that principle in its relation to the heart, and have assigned to it the power by means of which the contraction of that organ takes place. One of its essential properties, in alliance with the elastic tissues, is *contractility*. The heart expands by the force of its elastic structure, but it contracts by the force of its vital properties.

The same properties, in a different modification, are recognised in the alimentary canal; in the urinary-bladder; thoracic duct, &c. If these several parts be examined in a living animal, the mind will become satisfied that the *vital* action or movement consists in *contraction* merely, and that the *dilatation* of the tube is caused by other agents. In the alimentary tube—take the large intestine as the best specimen—the dilatation of one portion is caused by the contraction of the portion immediately behind

forcing on the contents. A long series of such contractions and dilatations incessantly succeed each other, and, generally speaking, the dilated portions are filled principally with gas, which appears to be the agent—in addition to the excrementitious matter—employed for the purpose of expanding the tube.

The cavities of the different reservoirs are expanded by their fluid contents, in a measure opposed to both their inherent elasticity and vital contractility. For instance, if the bladder of an animal, when full of urine, be exposed, and a small puncture be made into it, as the urine escapes, the vessel contracts; which proves that not its vitality, but its *contents*, kept it in an expanded state. The tendency of its vital property is to cause it to contract; not to expand.

The arterial tunics are provided with other means of dilating their cavities. Their structure is of such a nature that, if either extended or compressed, as soon as the force which extended or compressed it is removed, it will instantly resume its former state. In other words, the coats of the vessels are endued with an elastic power which constantly tends to preserve their calibre of the same size.

But, as in the heart, that power is opposed by another, capable, in some measure, of overcoming its effects. The difference appears to be, that in the heart its action is alternate with that dependent upon the elastic structure of the organ ; whereas in the arteries the contractile force is unceasingly in operation.

We now come to the most important part of this subject. A material fact, which has been overlooked by physiologists, is, that the calibre of the arterial tubes is always below that point which would obtain if the vessels were allowed to submit to their innate elastic forces. Instead of obeying the laws of dead matter, and of remaining at that state at which their elastic medium would place them, they are forced to submit to the vital force of contractility, and thereby reduce their canals to some extent below that medium.

This subject has been already discussed in another place. The present work will not permit its being fully entered into. It must suffice to state generally, that experiments have proved the fact, that if an animal be gradually bled to death the arteries will reduce their calibres more and more, until their canals become, ultimately, almost obliterated ; and that, when the animal has become actually dead, and has remained so for some time—sometimes longer and sometimes shorter—the vessels will again dilate and assume that state in which consists the medium of their elasticity as dead matter, at which point they will afterwards remain.

Moreover, the circumference of some of the principal arterial branches has been measured in animals from whom no blood had been previously abstracted ; the animals were then killed, and the vessels injected without any force beyond that necessary to throw in the wax. In every instance where the experiment was accurately

and satisfactorily made, the vessels measured more *after* than *before* death.

This remarkable property of the arteries increases in degree as we approach the extremities of the vessels. In the root of the aorta it appears to be quiescent during the ordinary state of the circulation. On the contrary, as we stated before, that portion of the tube is forced somewhat *beyond* its medium of elasticity at every contraction of the left ventricle. This must tend to soften the jerk caused by the sudden contraction of the heart upon the column of blood, and to modify the motion of the current.

As the blood moves onward it enters into a more capacious channel, and its velocity becomes less and less at every step, until, in the extreme branches, its motion is so slow that the jarring of the heart is not at all felt. The fluid glides on slowly and in an even stream, as may be seen with the microscope, and as is also proved when the skin is pricked.

Now, independently of direct experiments, there are several acknowledged facts which prove the blood-vessels to be more capacious after death than during life. We have already noticed the practical knowledge of butchers, that an animal may be drained of nearly all its blood by slaughtering it by repeated bleedings, instead of by one bleeding. This can only happen by the vessels closing themselves, by means of their vital contractility, upon what remains of the blood after each abstraction. After death has occurred they are again expanded by the influence of their elastic property.

When a ligature is applied to an artery the vessel beyond it will contract into a thin cord, and will become in time perfectly impervious.

Again, we are well aware that when an artery of a moderate size is cut across, and left exposed, the bleeding soon ceases, in consequence of the circular contraction of the vessel, until, at last, only a little lymph is seen to ooze out. If the contraction depended upon its elasticity it would take place immediately on the vessel being divided.

Moreover, it is a well known fact, that the vessels generally *are not half full of blood after death*. Why should that be the case? During life they are quite *full*, as has been already stated. Is it that a great part of the blood has escaped, or is it that its vessels have become enlarged, that such a difference should be found to exist in the two states? It cannot be denied that some of the serum of the blood exudes through the coats of the vessels some hours after death, but that such a quantity as would be required to fill up the vacancy observed in the arteries should escape in that manner is by no means probable.

It will, perhaps, be asked, how is the fact to be accounted for, that the arteries empty themselves at the time of death, if they exert no propelling power on the blood? The reply is, that the arteries render no assistance to the heart as far as relieving that organ of

any power which may be necessary to move the column of blood all the way round, from the left to the right side, is concerned. The organ is endued with sufficient power to do so without any aid. But when the action of the heart has ceased, there is then a small degree of power exerted by the vessels on their contents, and that force results from their vital contractility.

It must be considered that the blood moves along a channel whose area is continually increasing ; and that, therefore, the obstacles to its motion are much less than if the tubes were of the same diameter throughout. Now, as death approaches, the blood first begins to meet with an obstruction in the lungs, owing to the failing of the respiratory functions. The left side of the heart, not receiving its regular supply of blood, acquires a quick but feeble action, which proceeds from little to less, until, at last, its movements entirely cease. During this time the arterial tubes are also deficiently supplied, and, according to that law which induces them to preserve their mutual relations with their contents, they gradually contract more and more as the heart's action diminishes, until their canals become almost obliterated by the time that death actually takes place. By this slow and gradual contraction, and the channel gradually increasing in area, from the root of the aorta to the utmost extent of its branches, the gentle pressure of the coats of the vessels on the blood induces it to move forward towards the capillaries. But when death has actually ensued the coats expand again, by the elasticity of their structure, and present, on examination, the appearance of large empty tubes.

To sum up this part of the subject, we may conclude; 1st. That the contraction of the heart depends upon a vital cause ; but that its expansion is owing to the natural elasticity of its structure.

2d. That no motion takes place in the arteries calculated to propel the blood forward. That the heart is the sole agent which moves the blood through the arteries, and that the latter are mere passive tubes as far as the circulation is concerned.

3d. That the pulse depends solely upon the contraction of the left ventricle ; that it is simultaneous in every part of the body, corresponding to the action of the heart, and that the arteries themselves possess no power of pulsating.

4th. That the only mechanical motion connected with the arteries is a gradual contraction, dependent upon their vital contractility, and a gradual dilatation, dependent upon their elasticity, so as to enable them to adapt themselves to the quantity of blood which they contain at the time.

5th. That the diameter of all the arterial branches is smaller during life than after death : that, during the former state, their contractile property retains their calibre below their medium of elasticity, but that, when the vital principle has actually forsaken their coats, they acquire that medium, by the elastic force of their structure.

On the Pathology of Inflammation.

The *elements* of inflammation, from Celsus down to the present time, have been considered to be pain, heat, redness, and swelling. That the disease is generally attended by these marks cannot be denied, but, according to the pathology of the present day, appearances called inflammation are often seen in parts after death where two, at any rate, of the elements have been unobserved during life.

We shall first consider the two last of the four essentials above mentioned, namely, the redness and swelling which are presented to the eye and feel of the observer by a seat undergoing the process of inflammation.

That the *redness* of the part is owing to the quantity of blood contained in it, cannot be doubted, and, we believe, has not been disputed; but the question is, by what pathological process does the part acquire the increased quantity? Some will answer, " by an increased action of its arteries;" while others again will maintain that the disturbance is caused by " increased action of the heart:" while some will attribute all the mischief to the " irritability of the nerves."

That the arteries do not *act* in the way generally supposed, has been already shown. They do not do so even in their principal branches; much less do they at their extremities. In the smaller vessels the blood glides on in a smooth and even stream, and presents no appearance of being pushed about by the action of the arteries; nor does it seem to suffer any of the shock by which it was first put in motion.

But supposing the arteries did act as represented: how could they, by that means, increase the quantity of blood in the inflamed part? In the first place, the arteries could dispose of no more blood than was supplied to them by the heart; and, in the second place, an increased action of the arteries of a part, far from tending to *augment* the quantity of blood in it, would necessarily tend to *diminish* that quantity. The quicker they acted the faster the fluid would be driven on to the veins, and, instead of presenting an appearance of redness, the part ought to put on a paler aspect than natural.

How an increased action of the heart can determine more blood, in proportion, to one part than to another, it is difficult to understand. The left ventricle of the heart contracts and throws out its contents into the aorta; this quantum is pushed on by another discharge from behind, and the same thing goes on in uninterrupted succession. This is all the mechanical influence which the organ exerts on the blood. Now, we frequently find one leg of a person inflamed while the other is healthy; but how can the heart direct more blood to one leg than to the other? When the organ has discharged the blood into the aorta, it has done with it. It cannot, therefore, be the agent which distributes or apportions the fluid to

the different parts of the body. If we could suppose the whole body to be in a state of inflammation, we might then, by a stretch of the imagination, suppose the increased action of the heart to be the cause of it; but the notion that the heart can produce a greater determination of blood than natural to a particular part is inconsistent with possibility.

All obscure phenomena are generally attributed to causes equally obscure—upon the principle, probably, that inasmuch as two negatives will make a positive, so ought two obscurities to make one transparency. The functions of the capillaries are but little understood: their properties, and the mode by which they perform those functions, are still less so; consequently, various effects, which could not be otherwise accounted for, have been attributed to them. They have been supposed to be the agents which relieve the arteries of their contents at the time of death, and in order to be able to perform that office they have had various imaginary properties conferred on them. By some they have been supposed to act their part by suction: others have thought attraction to be the means employed for the accomplishment of the object; but whether they act by means of the one or the other of these properties, or by any other property, it is certain that physiologists have relied greatly upon the aid of these diminutive giants for the accomplishment of phenomena for which they could not otherwise account.

As a *prima facie* proof that the arteries are not exhausted of their contents by any power of suction, or of attraction, in the capillaries, the greater part of the blood after death is found to have passed *quite through them*, into the veins. The capillaries of the skin contain scarcely any blood after death in ordinary cases, and those of other seats much less than they do during life, in proportion to the quantity in the system. If the capillaries exerted an attractive power on the blood the consequence would be, that the fluid would move towards them from both sides, that is, both from the arterial and venous sides, and the capillaries themselves would be found to form the centre of the mass. Even if their relations were with the arterial blood only, the greater part of the fluid must be found in their immediate neighbourhood if any attractive influence existed between the two. The same would be the case if they could by possibility be supposed to exert a power of suction on it. But we find the blood principally in the veins, as before stated, and in the pulmonary artery, having passed quite through the supposed seat of attraction.

A power of suction must presume a vacuum in the capillary vessels, and a degree of atmospheric pressure on the arterial tubes sufficient to compress their parietes, so as to push on the fluid within. What is there in the mechanism and structure of the capillaries calculated to enable them to cause a vacuum? While the blood is circulating, the capillary tubes are full of fluid, and, while in this state, it is evident that they can exert no power of suction on the rest of the mass. Even if we suppose them empty—which

would be supposing a thing which can hardly happen—still they must possess some innate power of expansion, so as to create a vacuum within, before any effect could be produced upon the blood in their neighbourhood. We know of no such power connected with the capillary tubes. Indeed, we know of no inherent power of expansion in any of the tissues, except that dependent upon the elasticity of their structure.

A power of suction in the capillaries must also, as stated, presume a degree of atmospheric pressure on the arterial system sufficient to compress the coats of the vessels and to diminish the diameter of their tubes.

Now, that the pressure of the atmosphere on the arteries, as well as on all other parts of the body, except the interior of the skull and of the cylindrical bones, is very considerable, no one can dispute. It is, in fact, equal to about fifteen pounds to every square inch of surface. It is also true that by relieving a part from some of that pressure—for instance, by the application of an exhausted cupping-glass—the arteries will expand very considerably, and the part immediately acquires a greater influx of blood. But it must be borne in mind that this is not the *natural* state of the part. The circumstances under which it is placed by the application of the exhausted glass are different from those under which nature intended it should exist. Under the ordinary pressure of the atmosphere the arteries will maintain a certain calibre. If the pressure be increased by any extraordinary weight—by standing up to the neck in water for instance—their diameter will necessarily diminish. If, on the other hand, the weight be reduced—as by the application of an exhausted glass—their diameter will increase.

As the arteries, therefore, are destined to bear the ordinary pressure of the atmosphere on the surface of the globe without undergoing a change of calibre; and as this pressure is *equal* on all the surface of the body, and on the internal parts, through the medium of the soft structure—on the capillary tubes as well as on the arterial branches—it is evident that it can contribute no share whatever towards forwarding the blood from the trunks towards the extremities of the arterial system.

With regard to capillary attraction being the cause of preternatural determination of blood to a part, it may be said that this cause, if it existed, ought to act at all times the same. It ought to act in one part as well as in another. What can make the capillaries of an inflamed leg more attractive than those of the other leg?

We shall not enquire at present what share the nerves may exercise in producing the phenomena of inflammation; but it must be clear to every one that they can exert no *mechanical* influence on the blood. They may, or may not, conduce to modify the vitality of the vessels, so as to induce them to put on those appearances which they exhibit in an inflamed part, but the nerves cannot, as direct agents, attract the blood from one part to another.

All these causes failing to account for the mechanical phenomena —that is, the redness and swelling—of inflammation, it becomes necessary to seek for some other causes which, so far as we are acquainted, have not yet been pointed out by authors.

Physiology is a science applicable to *living* bodies alone; no theory, therefore, which does not take into its estimate the properties of life can be founded on facts. A living body is endued with all the qualities of dead matter. It possesses form, solidity, weight, colour, extension, and all other properties which are capable of being recognised by the organs of sense. Its elements are also subject to chemical laws, like those of the rest of the material world; and by the new combinations into which they may enter, and the new relations which they may form with one another in the order of causation, either parts or the whole of the material fabric may undergo extensive changes in constitution. But living bodies possess some properties in *addition* to those common to matter in general, and these are the properties which stamp their character, and which distinguish them from dead matter.

It will be asked, perhaps, what do these properties consist in? In reply it can only be said that they are to be recognised from their phenomena or effects in union with tangible matter—or, in a physiological sense, in relation with the materials of which the body is composed—but so far as the essence or principle upon which they immediately depend is concerned, it would be extraneous to the object of this work to institute any enquiry. Those who feel curiosity respecting such speculations are referred to the essays already alluded to.

The *properties* of life manifest themselves in their alliance with particular seats or organs only. In a word, all the phenomena which an organ is proved to produce during life, and which it is *incapable* of producing after death, are fairly attributable to the vital properties connected with it. During life the liver will produce bile: after death it will not do so. Now, as we know, at any rate assume, bile to be manufactured from the blood, and as we call that species of change "secretion," we have a right to infer that the vital properties of the liver confer the power of *secretion* on that organ. In the stomach it is the same: in the kidney, the pancreas, the salivary glands, &c., it is again the same: yet, still, it must not be forgotten that the "secretion" is *special*—that it is differently modified—in every secreting organ.

Again, life manifests itself in the nerves by the phenomenon of sensation. A dead nerve will not feel, though perfect so far as structure is concerned. In connection with nervous matter, then, the vital principle is the agent of *sensibility*, and the phenomenon resulting from the alliance of the two is sensation.

Moreover, if we examine—as we have already partly done—the properties of life in their relations with the elastic tissues, we shall find invariably that the phenomenon presented by the union of the two is contraction. This being the case, we are justified in in-

ferring that nature destined the vital properties of these tissues to be those of *contractility*. In this class of tissues may be placed the heart, the arteries, the veins, the absorbents, the alimentary canal, the urinary and gall bladders, the ducts of the secretory glands, the uterus, &c., in all of which contraction is the *vital* function, and the opposing notion, namely, dilatation, as before observed, depends either upon the innate elasticity of the structure, or upon the internal pressure of the contents of the vessel.

In the arteries, as well as in every distinct seat, the vital properties are modified of such a nature as to suit them for the peculiar office which the vessels have to perform. In the heart they manifest themselves by a *quick* and *sudden* contraction; in the arterial tubes, on the contrary, the contraction is *slow* and *gradual*, and, during perfectly healthy state, *uniform in proportion* throughout the whole arterial system. The tubes are always full: if a pound of blood be abstracted, the vessels adapt themselves closely to the remainder: when the mass of blood increases, by the sudden absorption of liquids from the alimentary canal, or by the gradual augmentation of the circulating fluid, the calibre of the tubes, on the contrary, enlarges, so as still to suit them to the increased diameter of the column. This dilatation is caused by the contractile or vital properties giving way to the innate elastic force of the tunics, in a manner analogous to that of the dilatation of the heart after the contraction of its ventricles has ceased. We may infer that the arteries are never filled up to the point constituting their *medium of elasticity;* and that such a state of plenitude *could not exist*, not only compatibly with health, but even with life.

The power of adaptation to the quantity of their contents increases in a progressive ratio as we trace the tubes from the root of the aorta towards the capillaries. In the extreme branches of the arterial system the range of change in the area in the channels is very considerable. We sometimes witness a transient blush overspread the pallid face. In such a case it is probable that the diameter of the vessels doubles itself at least. But their dilatation is often only momentary: their contractile properties soon resume their power: their calibre decreases; and the "*redness*" entirely disappears in a few minutes. In an *inflamed* part the *mechanism* is precisely the same; but the *cause* is different, and the *effect*, being according to the nature of the cause, is more permanent.

In a work intended to lead to *practical* results it would be inconsistent to enter intoany the oretical speculations respecting the immediate or proximate cause of these phenomena. With regard to the phenomena themselves, and the properties of the different tissues upon which our remarks have been made, any one may satisfy himself who will take the trouble to examine the facts, and to bestow a moment's reflection upon them. It is sufficient, in this place, to state, that there exists a certain vital relation between the blood-vessels and their contents, which enables them to adapt themselves to each other, and to maintain a regular proportion between

the one and the other. Whether the vital properties be immediately and solely connected with the nervous fibrils, or with some other particular tissue, or whether they pervade all the coats of the vessels, does not come within the province of enquiry at present; for it is enough to know the fact that certain phenomena are manifested by certain tissues and certain organs in a vital state, which those tissues and organs are incapable of exhibiting in a state of death.

Now, in the case of blushing, it is often that the face alone assumes increased redness. It may be asked, how do the arterial branches of one part only of the body manage to acquire more blood than their due proportion? The heart pumps out the fluid equally for the benefit of all the branches. The power, therefore, of causing the disproportion must reside in the arteries themselves. Then comes the question—the most *important* question—by what process, or by what means, do the arteries of one seat succeed in obtaining more than their proportionate share of blood?

The answer is short and clear—*simply and solely by enlarging their diameters or calibres in that seat.*

We have already proved that the arteries are mere passive tubes so far as the movement of the blood is concerned: that they are never in a state of *forced* distension, although it is quite possible that they may sometimes contain more blood than is compatible with health: that they do not pulsate: that their calibres are always below the point constituting the medium of their elasticity as material bodies: that their only mechanical movement consists in a gradual diminution and a gradual dilatation of their canals, so as to fit them to the diminution and increase of the mass of blood: that the range of this movement extends downward from that point which forms the medium of their elasticity, to an almost obliteration of their canals: that the movement is regulated by two distinct and different causes, namely, the diminution of calibre by vital contractility—a property connected with the life of the vessels, and the augmentation of calibre by elasticity—a property dependent on the peculiar structure of the arterial coats.

When these properties of the arteries are considered, it is easy to conceive that the contractile force may vary in degree in different seats. We may again refer to the case of blushing, where a sudden mental emotion causes a temporary reduction of the contractile power, so as to allow the vessels to expand by the force of their elastic property, and admit into their canals more than their proportionate share of blood. Soon, however, the contractile force returns : the vessels resume their natural calibre ; the circulation is equalised throughout the system, and the local seat loses its "redness" and recovers its natural hue.

Now, if the *cause* were different—if it were of such a nature as to weaken *permanently* the contractile power of the vessels—more especially if it totally *destroyed* that power—*then* the vessels would be *incapable* of resuming their natural diameters ; an undue pro-

portion of blood would constantly exist in them; the seat of the disturbance would present the appearance of redness, and some degree of swelling, and furnish all the characters of incipient IN-FLAMMATION.

In a word, the visible and tangible characters of inflammation depend entirely and solely upon an undue enlargement of the capillary extremities of the arteries. The enlargement may, and often does, extend some distance towards the larger branches, but its origin is invariably in the capillary tubes, and its extension takes place by continuity along the vessels. This enlargement enables them, as a matter of course, to hold more blood than the quantity naturally or proportionally belonging to them; which circumstance is the cause of the "redness" of the inflamed part.

Owing to the increased calibre of myriads of minute vessels, and, consequently, to their containing more blood than usual, the seat of disease presents, as a matter of necessity, the character of "swelling;" which is very properly laid down as another element of inflammation. But, after a time, the swelling takes on a different character, and is dependent upon a very different cause. The capillary tubes, having lost their contractile property, and their substance having, consequently, become relaxed and their parietes become thinner, allow some of the more serous portion of the blood to ooze through, the albumen of which coagulates in the interstitial spaces of the inflamed part, and gives rise to a more durable "swelling" than that by which the disease was distinguished in its more incipient stage.

We shall not, in this place, enquire into the cause of animal heat, for it would be foreign to the intention of this work. It may be stated as a general fact, but not without exceptions, that the heat of a part bears some proportion to the quantity of blood it contains. It is possible that the heat of an inflamed part may be sometimes greater than that of the blood in the great arterial trunks; but the facts we possess are not sufficient to decide that point. It is undeniable that the temperature of the blood is, in general, higher in the trunks than in the extremities of the vessels. Now, as there is an undue accumulation of blood in an inflamed part, it is natural, according to the above fact, that there should also be an increased accumulation of "heat." Another fact may likewise be noticed, which we shall point out more particularly by-and-by, namely, that the motion of the blood is very slow in a seat undergoing the process of inflammation, so that more time is allowed for the fluid to disengage its caloric than in the ordinary course of the circulation in the same seat. There are, therefore, two physical causes to account for the augmented temperature in the seat of inflammation; which are, first, a superabundance of the fluid vehicle, charged with the distribution of heat; and, second, the diminished velocity of that fluid in the inflamed part, thereby allowing more time for the extrication of its caloric.

With regard to the influence of the *nerves* in the production of

increased heat, we deny not the fact; nor do we, on the contrary, fully acknowledge it. *If it be* a fact, it can only be stated as such; for by what means the nerves are capable of raising the temperature of a part has not yet been explained. It may be casually remarked, that the mere *sensation* of heat in a part is not always a proof of increased temperature when tested by the thermometer.

We now come to the consideration of the remaining element of inflammation, namely, "pain." What is pain? What are its relations? Has it any tangible properties? Is it a physical entity, forming a link in the chain of causation? Or is it a mental, immaterial essence, which cannot be analysed.

Nature appears to have endowed every being with a disposition to preserve its identity. *Why* she should have done so, it would not be a very profitable employment of time to enquire, for the enquiry could lead to no satisfactory result. It is sufficient to know, that from a drop of dew on the cabbage leaf, up to the "lord of the creation" himself, there reside in the being an innate disposition to self-existence, and an inherent and unceasing effort to self-preservation. The drop of dew, or a drop of quicksilver, or a piece of chalk, or a crystal of Glauber's salts, or a rose tree, or an insect, or man himself, will, one and all, resist a change of form and a dissolution of identity of the being until subjected to some cause stronger than that by means of which the identity is preserved.

Now it would be a mere useless speculation to argue the point, as to whether inanimate bodies, or even vegetables, suffer any thing *analogous* to pain in the transition from one state to another; but pain appears to be an almost—we may say, in a strict philosophical sense, absolutely—essential attendant on the change of form—that is, on the process of death—in animal bodies. It precedes the actual dissolution or the change of identity of the being, and is probably intended to warn him of the existence, or the approach, of causes inimical to him. This property, like every other recognised in the animal body, is in alliance with a certain organisation or special tissue. The pain is a nullity in the seat of the inflammation, and can only be developed in its full character by its communication with the brain.

It may be said that pain is an effect, composed of elements: that it is no pain without the combination of all its elements: that these are derived partly from the brain, and partly from the seat of disease: that the three other elements of inflammation may exist in combination without "pain," unless a direct nervous communication subsists between the seat of disease and the brain; and that, on the contrary, pain can have no existence in the absence of all derangement of some part of the body. Pain, then, is a vital effect—an effect peculiar to living bodies—resulting from the combination of causes derived partly from the seat of derangement and partly from the brain. It is an index implanted by nature to warn the individual that there is something wrong in the economy—

that causes are in operation, which, if not neutralised by other causes, may lead to a change of identity.

We must now return, in order to account for some physical phenomena, which have only been yet casually noticed, connected with inflammation.

The exciting causes of inflammation are many and various, and are very different in their nature; but the proximate cause, or, more properly speaking, the mechanical condition of the extreme vessels of the inflamed part, is the same in every case. The exciting cause may be *mechanical*, such as the prick of a pin; the laceration of the soft parts; a blow from a heavy body; an incision by a sharp instrument, &c.: or, it may be *chemical*, such as the effect of corrosive acids, or other caustic substances; the effect of intense caloric; of irritating substances, either animal or vegetable, which have the property of removing the cuticle, &c.: or it may be of that nature which, for want of a more determinate term, may be called *vital*—that is, the cause may consist in the relation or operation of agents conveyed to the part through the medium of the blood, or some other vehicle, which agents are not cognisable by our senses: in other words, our means of examination are not sufficiently perfect to enable us to obtain a precise knowledge of their nature.

But, notwithstanding the great variety of causes which may conduce to give existence to those phenomena which, according to the pathology of the present day, when combined in the same seat, are called "inflammation," *the invariable effect of all of them on the capillary vessels is to diminish the contractile power of those vessels*, so as to enable them to give way to the elastic force of their structure, and to the increased pressure of the blood within them, which increase, as we shall presently show, is a necessary consequence of their altered condition.

As this subject is of the first importance, and as we are anxious that our views should be well understood, in order, if correct, that they may be generally adopted, or in order, if erroneous, that they may be refuted, we must be permitted to enlarge a little on it here.

As the arteries are mere passive tubes in the function of circulation, the motion of the blood through them must necessarily obey the same laws as the motion of fluid in inanimate tubes similarly constructed. It is influenced by gravitation; by atmospheric pressure, to the extent already stated; by the increasing and decreasing area of the different parts of the channels along which the fluid moves; by the number and degrees of the angles which it meets in its course; by the friction caused by its contact with its conducting tubes, and by other causes which influence the motion of fluids in confined canals.

As the heart forces the blood forward, by *vis a tergo*, into the canal of the arteries, it must follow that it will find its way in equal *proportions* into all the arterial branches in their ordinary or natural state. The proportion must, of course, be calculated from the

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diameter of the arterial trunk and all its branches. The velocity
of the fluid in all the system, as well as the quantity of it moving
through every branch, will maintain its due proportion as long as
the tubes are in their natural and healthy state. The quantity
passing through each arterial branch will be according to the size
of that branch, allowing for the difference in the angles of the dif-
ferent vessels.

It is necessary to distinguish between *velocity* and *quantity* of
motion. Velocity of motion may be the same in one drop of fluid
as in a gallon, and so may the quantity; but before the two can be
equal the drop must move 61440 times faster than the gallon. If
we suppose the drop and the gallon to pass through equal space in
equal time, their velocity will be equal; but as the gallon contains
61440 times the quantity of fluid which the drop does, the quan-
tity of motion in the gallon will be that number of times greater
than in the single drop. Quantity, in a word, is made up of the
velocity and weight of the moving body; whereas velocity regards
the time only which a body occupies in moving through a given
space, and has no relation to the weight of that body.

Now, if fluid be forced, or be allowed to flow, through a tube
varying in diameter in different parts, the *velocity* of its motion
will also vary in exact proportion to the variation of the diameter
of the canal in which it moves; still the *quantity* of fluid which
will pass through every inch of the length of the canal in a given
time will be precisely the same. Where the tube is narrower the
velocity will be greater, and where the tube is larger the velocity
will be less; but the diminished velocity will be made up in the
increased diameter of the column of fluid in the wider parts. If we
suppose such a tube to vary even fifty times in its diameter in the
course of its length, any quantity of fluid moving through it, sup-
posing it to be full, will pass in equal time through every inch of
its length. In the narrower parts, the velocity will be great, but
the diameter of the column will be small: in the wider parts, the
velocity will be slow, but the diameter of the column will be great;
so that the result will be, that precisely the same quantity will be
discharged at one end as will have entered at the other.

If we suppose the diameter of the aorta to be equal to two, and
that of its branches collectively to be equal to four, it will follow
that, as *all* the blood injected into the former must pass through
the latter, so its velocity in the former will be double that in the
latter. But, as a strike off against the rapidity of movement in
the aorta, the column of blood in the branches collectively will be
double that in the trunk. Thus, if we add the diameter of the
column in the trunk to its velocity, the product will be the *quan-
tity* of motion: if again we add the diameter of the column in the
extreme branches to the velocity with which the blood moves in
them, the product will be the same in both—we shall have the
same *quantity*. In a word, the velocity will bear an inverse pro-
portion to the diameter; whereas the quantity that will move

through any given space in a given time will be the same in every part, notwithstanding the variation in the diameter of the different parts of the tube.

A necessary consequence that must follow from the above facts is, that the quantity of fluid *existing* at any time in a wider portion of the tube must be greater than that existing in a narrower portion of the same length. If we suppose an aneurism of the trunk of the aorta, for instance, it is evident that more blood is contained in the aneurismal sac than in any other portion of the vessel of equal length ; but it is equally evident that not a larger quantity of blood can pass through the sac in a given time, than through a space of the same length in another part of the tube ; because the amount discharged at the distal side must be just equal to that which entered at the proxymal side of the aneurism.

In the same manner, as the diameter of the capillary branches collectively is very considerably greater than that of the root of the aorta, so the quantity of blood *actually existing* in every inch of their length, *collectively*, must be, even in their natural and healthy state, incalculably greater than that contained in an inch of the aorta. But in proportion as the area of the channel increases, so does the velocity of the motion decrease, until, towards the extreme ends of the tubes, the fluid glides on at a comparatively very slow rate. Owing to the elasticity of the fluid column, and to the slight yielding of the walls of the canal, the effect of the jarring action of the heart is entirely lost in the extreme branches of the system. The motion is even, and extremely slow, so as to allow time for the new relations into which the blood enters before its return by the veins.

From the foregoing facts it must follow, that, if the calibre of any one or more of the capillary branches should become enlarged from any cause, whether that enlargement be temporary or permanent, during the time of its continuance that branch or branches will contain more blood than their due proportion, according to the natural and healthy state. Another necessary consequence of the enlargement will be a diminution of velocity in the motion of the fluid through the enlarged branch or branches. This is the exact condition of the capillaries in a seat undergoing the process of inflammation. The contractile power of one or more of the extreme vessels is reduced, or sometimes destroyed, by some *cause*— the causes, as stated before, may be very various and dissimilar in their physical nature ;—the vessel then obeys the elastic force of its coats, and expands : the column of blood within, immediately, as a matter of course, augments its diameter ; its velocity diminishes in the inverse ratio of its increased diameter, and the part presents all the physical phenomena of inflammation.

It is clear that the exciting or morbific cause may act upon a narrower or upon a wider scale. For any thing we know to the contrary, it may sometimes consist in a mere obstruction in the extremity of one of the capillary tubes, thereby giving rise to the

commencement of the derangement; which derangement may extend to the tubes in the immediate neighbourhood of the obstructed vessel, and augment in degree as the extension increases. If such a cause ever exists its action must be mechanical, in the first instance, in its nature, like that of an external wound. It is probable that inflammation thus occasioned, in an otherwise healthy constitution, would be of a phlegmonous character; and it might extend by continuity of vessels over an extensive seat, as the disease often does when proceeding from an external wound. Or the cause may be of such a nature as to act upon a considerable number of tubes at once, and reduce, or totally destroy, according to its degree, their contractile powers. Such a cause would have its relations with the vital department of the vessels, and would modify, or entirely neutralise, the vital properties upon which their contractility depends. It may be supposed to be conveyed through the medium of the blood; and as it must be admitted that the vital properties of all the seats or tissues are differently modified, so we may easily conceive the morbific cause or principle to be capable of passing through various seats or tissues without forming any alliance with them, and yet to form a relation with another tissue to which it bears an affinity, and with which it may be brought into contact in the course of circulation. If such a cause be admitted, it may be inferred that the inflammation resulting from its operation would be of an erysipelatous character. But these speculative views may be either rejected or adopted, according to the reader's own fancy.

Whatever the nature of the cause may be, the mechanical condition of the capillaries is the same in kind in every species of inflammation. When the disease is slight, the enlargement of the vessels is not considerable, any more than the proportional quantity of blood contained in them. The velocity of its movement, also, is not much diminished. But, when the vessels have been entirely deprived of their contractile force, the enlargement proceeds to the utmost limit to which the vessels are capable of extending. The motion of the blood ceases; the fluid coagulates, and the inflamed part dies. An approach to this state of things, depending upon the same physical cause, takes place in almost every large aneurismal sac; the velocity of the blood through the enlarged space is so greatly diminished, compared with the rest of the vessel, that a part of the fluid coagulates in its cavity.

When the vessels have exceeded their natural calibre they become subject to another *mechanical* cause, whose constant tendency is to enlarge them more and more.

It is well known that, according to the laws of hydrostatics, fluid contained in vessels presses equally in all directions. The absolute pressure on the containing vessel will be in proportion to the extent of surface exposed to the fluid. The same rule holds good with regard to the arteries. The heart propels the blood into the aorta with a certain force: that force exerts a pressure on the

internal surface of the arteries according to the extent of that sur-
face—that is, the pressure is so much to every square inch, or the
square of any other measurement, according to the degree of force.
In the healthy state of the arteries, the thickness and strength of
their coats are proportionate to the diameter of the vessels; the
pressure is therefore in equal ratio throughout their whole course.
For instance, an inch in length of the aorta presents a much larger
surface to the blood than an inch in length of the radial artery: so
does an inch in length of the radial expose to the fluid a surface
considerably larger than an inch of a capillary tube; so that, as
the sum of pressure is in proportion to the extent of surface exposed
to the fluid, it must follow that the force exerted on an inch in
length of the aorta is very considerably greater than that exerted
on the same length of tube towards the arterial extremities.   But,
in order to secure the safety of the vessels, the coats of the trunk
and larger branches are made much thicker and stronger than those
of the extreme ramifications.

It will appear clear, from the above facts, that, when the capacity
of the capillaries in any seat becomes preternaturally or dispropor-
tionally enlarged, the pressure of the fluid within them will in-
crease in the same proportion as the enlargement.   The pressure
is according to the square of the surface, and if, instead of present-
ing a surface equal to 1, the vessels in their state of preternatural
enlargement or inflammation present a surface equal to 3, the force
exerted on their parietes will, of course, be three times that which
is natural to them.   The tendency, as well as the general conse-
quence, of this increased pressure must be, it is evident, to increase
their calibre still more; and the greater the preternatural expan-
sion. the greater will be the force tending to augment it.

We may refer again to an aneurismal sac in illustration of this
principle.   A small or incipient aneurism, is, comparatively, slow
in its growth, because, at its commencement, its diameter is not
much larger than that of the tube in which it is situated; conse-
quently, the pressure upon its parietes does not materially exceed
that on an equal length of the rest of the tube.   As, however, the
sac enlarges, the pressure equally increases, and the proportion
which originally existed between this part of the tube and the other
parts becomes less and less.   Having acquired a certain size, the
aneurism grows rapidly, because the force within it increases with
its growth.   When the sac is of a certain size, let us suppose there
to be a given pressure on its internal surface; when that surface
has doubled in extent, the pressure will also double in amount; so
that, at this point, the sac will have twice the tendency to enlarge
that it had when only half the size.   The enlargement and the
tendency to enlarge increase in a regular proportion.

The contractile force of the arteries must be considered as differ-
ing in degree in different individuals, in different parts of the same
individual, and in the same individual at different times.   In this
respect it is analogous to every vital property of which we possess

any knowledge. For instance, the liver secretes more regularly in one individual than in another; and the bile is more healthy in the same individual at one period than at another. Moreover, the secretion of the liver may be normal, and that of the kidney abnormal, in the same individual at the same time. In like manner, absorption may be deficient in the peritoneal cavity, and efficient in the cavity of the pleura, of the same person. In fact, the analogy is derived from every vital function in the body.

The above fact, applied to the capillary vessels, will account for the *degree* or *intensity* of the inflammation of any seat. The cause which acts in producing the disturbance of the equilibrium may be of such a nature as merely to weaken the contractile force of the tubes in the smallest degree; or it may be such as totally to destroy that force. Between these two points there are various degrees; and, as a consequence, the inflammation may present various degrees of intensity.

Although the least degree of expansion increases the tendency to a greater expansion, by reason of the augmented pressure within the tubes, yet there exists a provision, on the other hand, in the constitution of the vessels themselves, which acts in opposing the effects of that increased pressure. It must be borne in mind that the contractile power of the tubes serves to maintain their calibre at all times *below* that which would obtain if the elastic force were allowed its full play. It is evident that the more the calibre is reduced below the point of the medium of elasticity, the greater will be the resistance offered by the elastic power of the structure. The tendency to expand in the coats of the vessels—leaving out of consideration the pressure of the blood—diminishes as the expansion advances towards the medium of elasticity; so that the resistance to the contractile force becomes less and less as the calibre enlarges. The result must be, that, if the cause of the derangement be of such a nature as only to weaken the contractile power in a small degree, though the remaining power may not be able to retain the calibre in its normal state, yet, as its opposing force—namely, the elasticity—progressively decreases as the tubes expand, the power of contractility which remains may be sufficiently strong to prevent the expansion from extending very far.

It will, perhaps, be argued against all the foregoing views, that the capillary vessels of an inflamed part are *felt* to pulsate very strongly, therefore there must be an increased action of the vessels themselves; that the large branches running towards the inflamed seat beat much stronger than natural; and that the heart itself often partakes of the disturbance.

That the pulsation felt in the inflamed part is sometimes strong, cannot be denied. For instance, in a case of whitlow of the forefinger, or of inflammation of the hand, the inflamed seat is felt to throb strongly, and the pulse in the radial artery is found much stronger than natural. But these facts are easily accounted for without attributing any pulsating action to the vessels themselves.

If the radial artery, or any one of its larger branches, were to be exposed, in such a case no motion whatever would be seen in its coats.

Now, the strength of the pulse in an artery, as a general rule, is in proportion to the size or diameter of the vessel. The brachial beats much stronger than the radial; the femoral stronger than the anterior tibial, where it passes over the instep; the common carotid stronger than the temporal, &c. In fact, whatever artery be felt, there will be found a regular proportion between the size of the vessel and the strength of the pulse; and it may be stated that all *other* peculiarities in the pulse depend upon the action of the heart. We have then observed that the diameters of the vessels in an inflamed part are considerably increased in some cases, and that there is an augmentation of their calibre in every instance. In some instances, as in inflammation of the cornea of the eye, vessels which usually do not admit the red globules of the blood become equal to small needles in diameter, and present a red, arborescent appearance. This occasionally takes place even when the inflammation is not what is termed "very high" in degree; and the phenomena attending the disease in this peculiar tissue will furnish us with some idea of the increased diameter assumed by the capillaries in seats whose texture will more readily yield to the expansion of their coats. The phenomenon of pulsation in an inflamed seat depends upon the enlargement of myriads of vessels which are too small, in the healthy state, to impart to the finger the effect of the stroke of the heart, but which, in their state of enlargement, communicate the effect of the jar, as all other arteries of a similar diameter do. In consequence of this preternatural state, or preternatural enlargement, of the capillaries, if we place the hand on the seat of inflammation, we, of course, feel a regular and sometimes strong pulsation, upon precisely the same principle as we do in a larger vessel, namely, in consequence of the impression we produce in the arterial coats by the very means we use in feeling them—that is, the pressure of the fingers.

This subject may be illustrated by facts connected with certain tumours; with what are called "erectile tissues;" with nævi; with the gravid uterus, &c. In some sarcomatous tumours the arteries are found remarkably large, and they will communicate the feel of a very strong pulsation to a finger placed on them; yet the arterial connection of the tumour with the part on which it grows is sometimes so slight that the new growth may be removed without the slightest risk of hemorrhage. The fact is, that the arteries of the healthy part in the neighbourhood of the tumour have only slightly enlarged, and the pulse, if felt in them, would be of a strength similar to that of any other artery of the same size. But these are in connection with the arteries of the tumour: the column of blood is continuous through them into the latter vessels: the vessels of the new growth are very considerably larger than those immediately connecting it with the part in which it is situ-

ated : they bear a similar relation to the latter as an aneurism does to the artery to which it is attached : in consequence of their great size, of the column of blood being continuous between them and the heart, and of the pressure of the fluid within them being in proportion to the surface exposed to it—the resistance, in other words, the "pulse,"—is felt, as a matter of course, very strong if the finger be placed on them.

In a similar manner, the vessels of a nævus, whether arteries or veins, are very considerably larger than those which connect them to the general vascular system. So are likewise those of the gravid uterus. The strength of the pulse in each, and all, of them will be proportionate to the diameter of the artery *at the point where it is felt*, whether the vessel be connected by a small or a large branch to the general arterial system.

The derangement which gives rise to the inflammation may be very limited in extent, as may be noticed from the prick of a needle ; or very extensive, as often occurs from lacerated or punctured wounds, or in what is commonly called "spontaneous inflammation." When the cause is slight, the extent of the derangement is generally limited, and all the phenomena are slight. It is seldom, or never, that the inflamed part can be circumscribed by a distinct line of demarcation. Generally, the enlargement of the capillaries ends imperceptibly in the normal diameter of the branches with which they are continuous. At other times, the augmented calibre extends to some of the principal arterial branches leading to the inflamed part. When this occurs, the pulse felt in these branches will be, of necessity, stronger than natural, because the column of blood presses on a larger surface. For instance, in a severe inflammation of the hand or fingers, the radial artery will partake of the disturbance : it will lose a part of its contractile power : its calibre will sensibly enlarge : the diameter of the column of blood within it will consequently increase ; and, instead of imparting the sensation of a radial pulse, the amount of pressure on the finger will be such as to produce a pulse equal to that of the brachial artery in its ordinary state.

It may be noticed that the sensation of throbbing which the person himself, who is the subject of the inflammation, feels in the inflamed part, is owing to the tightness of the integuments, and to the density of the tissues surrounding the enlarged vessels. This tightness or density causes a compression of the parietes of the vessels, upon the same principle as the finger does in feeling the pulse ; and the coats react and impart the impulse to the nerves of sensation distributed in the integuments. In internal inflammations, such as pleuritis, peritonitis, &c., there is a total absence of the sensation of throbbing ; because, however the enlarged vessels may be compressed by the surrounding tissues, yet, as the nerves of the inflamed seat are not those destined for the office of sensation, and as the pulsation is not powerful enough to be communicated to the surface, through the medium of the parietes of the chest or abdomen,

like that of an aneurism, for instance, no sense of throbbing is per-
ceptible to the sufferer. The only feeling is that of *pain*, which, as
already observed, is a property attendant on almost all vital de-
rangements in the animal system.

That the action of the heart is often disturbed in cases of local
inflammation, affords no reason to conclude that the inflammation
depends upon the disturbance of the heart. That would be mis-
taking the effect for the cause. The action of the heart is disturbed
in hysteria, in hydrophobia, in epilepsy, in chorea, and in a variety
of other maladies wherein none of the phenomena of inflammation
are observable, but no one ever thought of attributing those affec-
tions to any derangement of the heart. The fact appears to be,
that, in inflammation, there exists a certain vital derangement—a
reduction of the vital powers—a modification of some of the vital
properties—and the necessary consequence is *pain :* pain is a pro-
perty related with the nervous system : the centre of this system, in
the higher animals, is in the brain : from the brain some of the
effects of the pain are transmitted to the heart, probably through
the medium of the same system, and the consequence is a derange-
ment of its natural function. In fewer and more common terms,
the derangement of the action of the heart is caused by the inflam-
mation ; not the inflammation by the derangement of the action of
the heart.

If the views we have taken respecting the properties of the arte-
ries are founded on facts, it might be considered sufficient to state
them simply, without any further explanation ; but as, possibly,
some may be disposed to dispute them, without taking the trouble
of examining the facts upon which they rest, we may be permitted
to say a few words upon the advantages derived from the nature
of those properties, and to show that they are the best adapted for
the functions which the arteries are destined to perform in the
animal economy.

That the coats of the arteries are endued with an elastic pro-
perty, no one will dispute. We are told, very justly, in all proba-
bility, as a general principle, "that nature does nothing in vain."
What, then, is the object of the elastic quality in the coats of the
arteries ? It will, perhaps, be answered, " to press the blood forward
along the tubes." But, before it can do so, it is clear that the ves-
sels must be first *forced out* beyond the medium of their elasticity,
and that they can only react on the blood by their resilient force,
or their effort to resume that medium. Now, let us ask, by what
power can they be forced out ? There is no power with which we
are acquainted that can act upon them, calculated to force their
expansion, except that of the heart. But, as it is a law of nature
that the resistance should be equal to the force applied, the power
of the heart would be totally wasted, or spent to no purpose, if it
went to force the vessels beyond the medium of their elasticity, in
order that, by their resilience or reaction, these vessels might, in
their turn, press the blood forward ; because the same quantity of

power which would be expended by the heart in dilating the arteries would suffice to move the column of blood a distance equal to that to which the re-action of the vessels would move it. In such a state of things, there would be one force set up to oppose another, without any object or advantage to be gained.

On the other hand, the reason why the ordinary and natural calibre of the arteries should range *below* the medium of their elasticity is quite clear, when once pointed out.

It will not, we presume, be disputed that the mass of blood in the body varies very considerably in quantity at different times. Some persons swallow two or three quarts of liquid within a short period, most of which remains for a time in the vessels, before the kidneys can act in throwing it off. In cases of cholera, we have injected *above two gallons* of water, containing carbonate of soda in solution, into the veins of persons at one time, yet nothing like over distension seemed to take place.[1] Some practitioners are in the habit of abstracting two or three pounds of blood at once in cases of inflammation, or of inflammatory fever, and a much larger quantity is frequently taken away by repeated bleedings within a short period of time. Now, if the contraction of the arteries depended upon their *elastic* quality, and their dilatation upon the force of the heart forcing the blood against their parietes, it is difficult to conceive how they could adapt themselves to the great

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[1] In the first patient in whose case this practice was adopted, we were, together with Dr. Furnivall of this town, who assisted us, rather surprised at the large capacity of the vascular system. He was a bargeman, naturally strong and healthy, but, before the operation, reduced, in a very few hours, to the very last stage of cholera. A vein in the arm was opened, and syringeful after syringeful injected, until nearly two gallons of fluid were thrown in before the skin appeared to change its aspect. Gradually, however, the interstices began to fill; the shriveled appearance of the skin began to relax; the blue colour gave way to a more natural hue, the man, who had been some time quite insensible, and in a state almost doubtful whether he was alive or not, opened his eyes, and became gradually able to answer questions put to him; the pulse became perceptible at the wrist, and the change was altogether most extraordinary. Considerably more than two gallons of fluid were injected, yet the surface of the body was hardly restored to its natural fulness. In this case there came on, shortly, attacks of an epileptic nature, which were repeated at intervals of some minutes until he died; which occurrence took place some hours afterwards. In five other cases, in which the injection was practised, the temporary good effects were equally striking; but not one of the patients permanently recovered. The practice was only adopted in the very last stage of the worst cases. They were all roused for a time, and none but the first suffered any cerebral affection from the injection, although equally large quantities of fluid were thrown in. The effects in all these cases were the following: as soon as, or immediately after, a sufficient quantity of fluid to rouse the patient was injected, either a vomiting came on, or the bowels acted, so that, in a few minutes, a quantity about equal to that injected was discharged from the body. A repetition of the experiment was invariably followed by the same train of effects; namely, first, a temporary rousing; then an enormous discharge from the bowels, leaving the patient each time in a state similar to that in which he was before the injection.

variation in the quantity of the fluid contained in them. If the quantity were great the force required on the part of the heart to dilate the vessels must be enormous, for it is in the nature of an elastic body to increase its resistance the more it is stretched beyond the medium of its elasticity. On the other hand, if the fluid were reduced in quantity, so as not to be sufficient to fill the vessels up to the medium of their elasticity, there would necessarily be a vacuum in some part or parts of their canals. If such were to happen, it is evident that a fatal disturbance must take place in the circulation. The column of blood would be broken, and the heart would not receive a regular supply of fluid to act upon.

But, regulated in their calibre by a vital property, which always retains their diameter below the medium of their elasticity, but which, owing to the vital relation subsisting between them and the blood, yields gradually to an increase in the quantity of their contents, the arteries are fully capable of adapting themselves to any variation which may take place in the circulating mass, so as, under all ordinary circumstances, to embrace the column of fluid in such a way as to leave no vacant space within the vessels. It may be said that the maximum of blood in the system, compatible with health, or perhaps with life, would fill up the vessels to that point which constitutes the medium of their elasticity. What the minimum may be is uncertain, but that the tubes are capable of diminishing their calibre to a very small comparative size, we have had abundance of proof.

As a guard against any inordinate pressure on the interior of the arteries, from over distention, the veins are so capacious, and so capable of accommodating themselves readily to the amount of their contents, that the mass of blood might temporarily receive great increase without causing very material inconvenience. The quantity of blood in the veins must depend upon that transmitted to them by the arteries. In a word, the arteries possess a complete command over the veins, and the calibre of the latter will be determined, as a general rule, by the supply which they receive from the former.

But it is, on the other hand, quite evident that a disturbance of the equilibrium between the two systems of vessels could not last long without causing serious injury. If we suppose the veins to contain more than their due proportion at any time, as one end of the column continually discharges itself into the right side of the heart, and thence into the lungs, these organs would soon become over-loaded if the left side were not equally ready and capable of passing it off into the arteries. In the natural state of the circulation the equilibrium is soon restored by the mutual correspondence of the action of the two sides, after having been disturbed by sudden exertion of the body, or any other cause. The circle must be at all times a continuous column : in other words, every artery and vein is *full* of fluid throughout the circle ; but their diameters will depend entirely upon the quantity of blood in the system.

From the facts which have been stated in this section, we are justified in concluding:

1. That the calibre of all the arterial branches, in the normal state, bears a uniform proportion throughout the system.

2. That the proportion is governed by a vital property residing in the coats of the vessels, and bearing a relation to the blood within them.

3. That any reduction in the amount of the vital power of the vessels will allow their calibre to be enlarged by the force of their elasticity.

4. That the immediate consequence of a preternatural enlargement of the vessels is an increased influx of blood into them.

5. That the visible phenomena of inflammation result from a number of the capillary branches of the arteries having lost a part, or the whole, of their contractile power, thereby having become enlarged in their calibre, so as to admit, and retain, an undue proportion of blood.

6. That, while the capillaries are in the state last mentioned, the velocity of blood within them undergoes a decrease, although the quantity of fluid existing in them has acquired an increase; which increase imparts to the seat of disease the character of redness.

7. That the strength of the pulsation of an artery—in other words, of the "pulse"—bears some ratio to the size of the vessel at the point where it is felt. Thus, if a branch whose diameter in one part is equal to 2, expands a short distance further on into a diameter equal to 4, the "pulse" felt at the latter part of the branch will be much stronger than that felt at the former, where the tube is smaller, although the latter is nearer the heart, which is the source of the pulsation.

8. That the throbbing felt in an inflamed part depends upon an increase of size which the capillaries have acquired in consequence of a reduction, or loss, of their contractile power; thereby presenting a larger internal surface to the force of the heart through the medium of the column of blood; and,

9. That the preternatural expansion may extend to a principal arterial branch leading to the seat of the inflammation, and, by consequence, may give rise to an increase of strength in the pulse in that branch compared with its normal state.

Cause of Difference in the Character of Inflammation.

What are the physical causes which serve to give inflammation the great varieties of character observed in different cases? In some cases it presents the appearance of hardly any thing more than a mere blush, attended with a slight pain, and a trifling increase of heat in the part, and its duration is almost the only thing which distinguishes it from a blush. In others, the characters of the disease are more striking; the redness shows a deeper body; the pain is more intense; there is a degree of fulness or swelling

of the part, and its temperature is augmented ; yet, in a few hours, or a few days, it may resume its natural state by means of the *vis medicatrix* of nature alone. Sometimes the disease spreads over a great extent of skin, without causing much disturbance among the deeper seated tissues ; whereas, at other times, the subcutaneous cellular membrane of nearly a whole limb may be destroyed by it, where the integuments themselves suffer comparatively little. In some instances, the vessels of the inflamed part assume a new function, and give rise to the formation of pus in one place, and in another throw out a mixture of lymph and fibrine, whilst in a third the fluid product is mere serum. In one case the disease eats up the part by piecemeal, or by small ulcerations, whereas, in other cases, it destroys the vitality of a whole limb at once. In fact, the varieties of character presented by " inflammation," according to the general application of the term, are very numerous.

The two principal divisions of inflammation made by authors has been into phlegmon and erysipelas. The former has been defined as being less disposed to spread than the latter ; more plethoric in its character ; less dangerous in its tendency, though more *active* in its nature ; the inflamed part opposing greater resistance to the pressure of the finger, and presenting more fulness and swelling, with a deeper intensity of redness. Erysipelas, on the other hand, has been considered more insidious in its character, sometimes spreading to a great extent without affording any clear proof of the magnitude of the mischief going forward ; to show, according to the common expression, less " action" in the inflamed seat, yet to have a greater tendency to destroy its vitality ; to oppose less resistance to pressure, and to be altogether more diffuse in its character than phlegmonous inflammation.

Now, that inflammation presents these extreme differences in different instances is well known to every practitioner ; but it is also equally certain that there are cases, even more numerous, occurring, which belong to the one class as much as to the other. In order to reconcile these, which, in truth, form the great majority, authors have termed the doubtful cases " phlegmonous erysipelas," thus thinking, we suppose, that they must be right if they applied a term embracing both divisions of the disease.

The principal divisions have been again subdivided in various ways. We have the " acute" and " chronic," which are the oldest terms we possess respecting the subdivision of the disease ; but the term " chronic" has been of late years changed for the term " subacute." So far as we can perceive, one is as applicable as the other ; but neither will convey any precise or distinct idea of either the nature or degree of the malady. How long must the inflammation last before the term " chronic" will apply to it ? Again, where is the line to be drawn between the " acute" and " sub-acute?" How are the degrees to be measured ? What is the scale to consist of ? *Intensity* of symptoms ? Who is to judge of the comparative intensity ? If we were to estimate the degree or intensity of the

disease by the heat, redness, and swelling observed in the part—which are the only outward signs of inflammation—we should often find all these much less in a limb on the point of running into a state of gangrene than in many cases where the tendency is considerably less serious. In some instances we find considerable redness, and some degree of swelling, without any perceptible increase of temperature, and unattended with any sensible pain. This state of the vessels is called congestion by some authors, and chronic inflammation by others.

From the great difference of opinion among pathologists, respecting the mode of classifying the varieties which inflammation presents in different cases, there is reason to suppose that various diseases are arbitrarily included in that term, which bear but slight, if any, resemblance to each other in their nature. That the same disease may differ in degree in different cases, is reasonable to suppose; but that the same disease should present itself sometimes in the form of a small pimple, as in the measles, and other exanthematous affections; at other times in a circumscribed tumour of a determinate extent, as in a common boil; in other instances in a diffused form, of unlimited extent, &c., and should lead to such a variety of terminations, is not probable; and we doubt the benefit that can arise, in a practical point of view, from viewing it in that light.

There are three things to be considered as determining the nature of a disease, and it is probable that these will embrace all the varieties which diseases can present under any circumstances. These are—

1st. The nature or properties of the cause which conduces to create the vital derangement;

2d. The tissue or immediate seat upon which the cause exerts its influence; and

3d. The general constitution of the patient, or the constitution of the tissue upon which the cause primarily acts.

In a work like the present, it is unnecessary to discuss these points at length, for the treatment of a disease is determined upon, in general, from the more prominent signs which characterise it. In order to point out, and to render clear, our notions respecting the immediate operation of various causes in the production of disease, more space would be occupied than can here be applied to the subject.

But it may be noticed shortly, that it should not be forgotten that disease is a state or condition of a part possessing vital properties; and that, in analysing its character, these properties should never be left out of the estimate. The properties of life might be discussed *physiologically* in the abstract, as distinct entities from those of the material fabric; but, in a *practical* point of view, it is convenient to consider them as parts of the constitution of the tissues with which they are connected. In looking upon them in this light, our enquiry should be directed to two points; first, what is

the amount of all that a tissue *can do:* in other words, what is the sum total of its functions? Second, in what way can that tissue *suffer*—what character does it put on under the influence of a morbific cause? In proceeding in an enquiry like this, the legitimate mode consists in not attributing any effects to vital properties which can be proved to depend upon mechanical causes; and, on the other hand, to assign to the vital department of the tissues those effects which, from their nature, cannot owe their existence to causes of a mechanical kind. For instance, the motion of the blood in the vessels has, among other causes, been attributed to an innate mobile power existing in the fluid itself. It is true that the globules of the blood, examined through a powerful microscope, are seen to move among themselves, even out of the vessels, for a short period, while the blood remains fluid; but this fact affords no proof that they are capable of progressive motion along the tubes of the vessels. Facts equally convincing, and even more so, prove that the blood is *not* capable of moving along the vessels by its own inherent impulse, for when the power of the heart is removed from it, its progressive motion immediately ceases.

On the other hand, it is evident, according to the extent of our present knowledge, that the secretion of bile, of gastric juice, &c., cannot be the effect of a mechanical cause, for we know of no analogous products emanating from any combination of mechanical powers. And although chemistry enables us to discover the material elements of which these secretions are composed when out of the body, yet no power of chemistry is capable of compounding fluids suited for the offices which these have to discharge in the animal economy.

Now, it is one property of every tissue endowed with life to preserve its own identity. In the course of the operations going on in the body every tissue maintains its own distinct character, notwithstanding the constant removal and renewal of the material molecules of which its structure is composed. The mucous membranes do not assume either the character or the functions of the serous membranes; nor do either of these transfer themselves into cellular tissue; nor into muscular fibres; nor into gland, &c. Each preserves itself, feeds itself, renovates itself; thus maintaining a marked character, which distinguishes it from all other tissues. As we know of no mechanical or chemical process in nature analogous to this, we are justified in attributing it to vital causes. Hence, each tissue, during life, is endowed with an innate power of preserving its own identity, by the agency of its vital properties.

The next thing which each tissue is capable of doing, is to perform the function for which it is destined. It will, perhaps, be said, that we know nothing of the nature of the powers by means of which it is capable of accomplishing such an object. It may be replied, that we are equally ignorant of the power which brings a stone to the earth; which binds together the particles of which the stone is composed; which determines one crystal to be different

from another, &c. We only know that certain properties are connected with the elementary constitution of bodies, which prompt or compel those bodies to do what they do; and that, when the same properties are in combination, the same effects will always follow. In this respect, our knowledge will apply with equal correctness to the functions of living parts. What we find these parts do, we know them capable of doing. In the normal state, each organ performs a distinct function, and observation has proved what that function is. Observation also proves that certain causes conduce, while operating, in modifying that function. As, therefore, facts prove these points respecting the nature and properties of the organs, it follows that, as every tissue which enters into the composition of each organ forms an essential part of its constitution, each tissue of which the structure of the organ is made up must possess properties peculiar to itself—properties differing in modification from those of all other tissues.

As mere conduits for the blood, the properties of the capillary vessels in all the organs, and all the tissues, are similar. The vessels are equally capable of adapting themselves to their contents in one seat as in another. Their elastic quality will expand them, and their contractile power will reduce their capacity, in the liver as well as in the stomach; in a serous, as well as in a mucous, membrane; in a gland as well as in a muscle: but it must be considered that *contractility* is only *one* vital property connected with them.

By examining this subject according to the principles already laid down, namely, that if the effect be different the cause must also be different, we are led to conclude that the modification of the vital properties of the capillaries is different in every seat—in every tissue of which an organ is composed. This conclusion is founded upon the facts, first, that the physical characters of all the tissues are different; and, second, that the nature of their functions is different. We may instance the liver and the kidneys in illustration of this point. Although *secretion* is the function of each, yet the product of the function is different, notwithstanding it is derived from the same mass of blood in both.

As all the structure, in the first step of vitality, and all the secretions resulting from the structure in a vital state, in the second step, are derived from the same common mass of blood, and as both are dependent upon some property connected with the extremities of the arteries, it must follow that if this property were the same in *all* the extremities, the structure must be the same in every part, and, as a consequence, there could be only *one* function. This proposition is as self-evident as that *two* and *three* will make *five*. The necessary inference, therefore, is, that the secerning, and in the secretory organs the secreting, extremities of the arteries—whatever their form or nature may otherwise be—differ in their vital properties in every tissue, so as to be suited for the particular office which they have to perform in each seat. In this respect

they are analogous to all the works of nature; and it would be as fruitless to enquire why they should be so, as to enquire why a heavy body should gravitate towards the earth. It must suffice to know that if the effect be different, the cause of that effect must be also different.

According to the foregoing view, the extreme vascular branches are different in their modification in every tissue, so as to suit them for their particular functions; although, in all parts, they possess the property of contractility, which enables them to adapt their calibre to their contents. As this is the case, it will follow, as a consequence, that even the same cause acting upon them in different tissues, may—nay, *must*, in some respects—give rise to different modifications of phenomena. *One* common consequence may follow in all, namely, dilatation of their canals, and, consequently, the admission of an undue share of blood, attended by the other characteristics of *inflammation;* but that inflammation must differ in its modification in every tissue, according to the peculiar properties of the vessels in each. As the various shades of difference in these properties cannot be defined, because the effects resulting from them are so minute, in some instances, as to escape our observation, we must found our illustrations upon tissues somewhat in the gross.

Now, as a general principle, we find the tendency of inflammation of the serous membranes to be the secretion of a sero-fibrinous fluid, and the formation of adhesions between their opposite surfaces. This is the case in the common or diffused variety of the disease. It is true, that, in some peculiar inflammations of those membranes, granular ulcerations and the secretion of pus are found to have taken place; but any one may satisfy himself that, in such cases, it is not the general serous tissue that has suffered as a principal, but certain points either enveloped within its texture, or situated immediately behind it. These points evidently differ in their physical characters from the membranous tissue itself; but as, like all other tissues, however small in size, they must owe their existence to vessels and to the blood, their arteries must be specially modified in their properties, and must, therefore, bear special relations or affinities to any causes which may act upon them. By continuity, or by immediate contiguity, the disturbance may, and always does more or less, extend to the vessels of the general tissue, which, consequently, is made to partake of the disease, and to give exit to its own peculiar morbid fluid, which becomes mixed with the more purulent matter emanating from the original seat of the disease. In almost all cases of this description, the leading characters of the inflammation are stamped by the properties of the tissue originally affected.

As an analogous principle, we find that the tendency of the mucous membranes, in a state of inflammation, is to secrete *pus*, and that this modification of tissue is not endued with that adhesive property which forms a distinguishing part of the character of the

serous membranes. Inflammation of the mucous tissues, also, has a much stronger tendency to cause softening and ulceration than that of any other tissues. Like the serous membranes, the mucous are liable to suffer in an extensive degree; in other words, their inflammation has a tendency to spread over a great part of their surface. Like the serous membranes, also, when traces of inflammation are found in circumscribed spots, it will be discovered, on close examination, that the origin of the disease was not in the membrane itself, but in certain points or glands either enveloped in its substance, or situated immediately in contact with it.

In the cellular membrane, again, we find the inflammation *sui generis*. When limited in extent, its tendency is to form a circumscribed abscess, if it does not terminate in what is commonly called "resolution." On the contrary, when the cause acts upon a wider scale, death ensues in the tissue, and extensive sloughings take place, if the vital powers of the general system be sufficiently strong to bear the effects of the constitutional disturbance. The tendency of the disease is similar in all the parenchymatous structures. The consequence, in its first degree, is a resumption of their normal state by the vessels—a restoration, by virtue of the *vis medicatrix*—of the innate principle of self-preservation implanted in the constitution of all bodies—of their contractile power. In its second degree, its tendency is to limit itself, by forming a circumscribed abscess. By this means the vessels are enabled to ease themselves of a part of their undue burthen. In the last degree, the consequence is the death of the tissue affected. Owing to the entire destruction of the contractile power of the capillary vessels, the blood, whose motion has decreased in velocity in proportion to the expansion of the tubes containing it, comes to a complete stagnation, and the secerning function—the function by means of which the structure is perpetuated—ceases. The result, of course, is the death of the part.

These peculiarities of inflammation in the different tissues are general in the animal body. Where they differ, the difference is only in modification, for the general character of the malady is the same. The same analogy is discoverable in all the tissues. When the skin is the seat of the inflammation, the disease puts on a very diffusive character, which has its peculiarity, like that of other seats. Here, it is commonly called erysipelas. As the vessels of the skin must be modified differently from those of all the other tissues, according to the principle already stated, it is natural that they should exhibit their sufferings, under the influence of a morbific cause, in a manner different from all others.

From the foregoing observations, then, it must, we should conceive, be admitted that the nature of the tissue affected has a considerable share in determining the character of the inflammation. In fact, we may say that the tissue constitutes the basis which is to form the distinguishing points in its character, because inflamma-

tion of the same tissue always presents phenomena very similar in their nature, though differing in degree and modification.

In the next place, it may be enquired how far the character of the inflammation is determined by the nature of the cause which produces it?

The fact cannot be refuted, that the same tissue presents, in general, similar characters while in a state of inflammation—that, as already observed, the serous membranes furnish a fluid peculiar to themselves, and show a great disposition to unite their surfaces—that the mucous membranes secrete pus, and are not disposed to form adhesions—that the cellular membranes, and the parenchymatous tissues, readily run on to sloughing, if the disease be so extensive as to preclude the formation of a limited abscess—that, in the true skin, the disease is diffuse in its character; peculiar in its sensations, owing to its immediate connection with the nerves of touch; dangerous in its tendency, owing, probably, to the same cause producing disturbance of the cerebral functions; that its secretions are serous or lymphatic, which appear in the form of blisters, similar to those secreted by the same tissue under the ac- tion of vesicatories. The same analogy applies to the glandular tissues. It is true that the liver, the kidneys, the mammæ, the testes, the pancreas, &c., each present diseases, in different cases, very unlike in their characters; but it must be remembered that every secreting, as well as other organ, is made up of various tis- sues, and that it may often happen that the real or original seat of the disease is not that tissue which gives its peculiar distinction to the organ, but a subsidiary tissue, such as the cellular, which per- vades all the other tissues. That this inference is not altogther hypothetical, is proved by the fact that each of these organs, as well, indeed, as every organ in the body, does present disease of a character peculiar to itself. That peculiar carcinoma which takes place in the mammæ never exhibits itself in any other tissue as an original disease. The kidney is subject to a peculiar granular affection, the like to which is not found in any other part of the body. The liver exhibits morbid appearances different from what is ever discovered in any other seat. It is the same with the pan- creas, testes, lymphatic glands, the thyroid gland, &c. How far additional and more minute examinations may hereafter enable us to find out the special seat of the various eruptive diseases, it is im- possible to tell, but as they, in every instance, present distinct and peculiar characters, it is legitimately to be inferred that they are allied with some special points or tissue distinct from the rest of the general structure.

But, although each tissue sets forth its diseases in a way peculiar to itself, and although the diseases of each agree at all times in the most prominent points of their character, yet the same tissue pre- sents great modifications in the character of its affections in different cases. The facts already stated are sufficient to prove the basis upon which the character of various inflammations is founded, but

there must be some other powers which determine the modifications of the disease. The question, then, is, what are those powers?

Now, an *effect* is sometimes made up of *many* causes: it must always consist of *more* than *one* cause. It has been already shown that one reason of the varieties put on by inflammation is the nature of the tissue affected. This cause is inherent in the constitution of each tissue, and plays its part in mankind generally, as well as in every individual case of inflammation. This cause forms the groundwork of the character. The next is the *exciting cause*. We mean by "exciting cause" not those *mediate* causes, such as cold and moisture, but that cause, whether mechanical, chemical, or vital, which acts immediately upon the living tissues. The enquiry, therefore, is, what facts are we in possession of to determine the manner in which such a cause acts?

It is a fact, in the first place, that any violence inflicted upon the vessels of a part, is a sufficient cause of inflammation of that part. Whether the violence be a blow, a laceration, a puncture, a cut, or whatever its nature may be, a *vital disturbance* is the result. *Why* living parts should be subject to any disturbance from violence, it would be just as profitable to enquire as why sulphuric acid should consume a piece of marble. By the next step we arrive at a point where we can trace causation better :—vital disturbance of a part is very soon followed by a dilatation of its capillary vessels, thereby inducing them to admit larger columns of blood : this is the first visible character of the inflammation. Now, the link in the chain of causation which binds the vital disturbance with the enlargement of the capillary tubes, appears to be this : any disturbance or derangement of the vital powers must tend to *weaken* those powers : the *natural* tendency and object of the vital powers, in the capillary vessels, is to regulate their contractility, and determine their calibres according to the nature and function of the tissue which they supply : the necessary consequence, therefore, of such disturbance or derangement must be dilatation of the tubes of the capillaries. Let us see in what respect this view could be disputed.

It will, perhaps, be maintained, that any disturbance of the vital powers must tend to increase, rather than diminish, their amount, and that, therefore, if their object be the contractility of the vessels, as represented, the calibre of the tubes ought to become *less* by the effect of violence applied to them—in other words, that derangement in any living part must add to the vital powers of that part, instead of taking away from those powers.

In reply, it may be said that such a view of the vital powers would be contrary to every analogy. It would be assuming, contrary to known fact, that the effect of disease is to render the body stronger than it was in a state of health ; or, in an analogous manner, that the more drops of sulphuric acid you let fall into a solution of carbonate of soda, the more carbonate of soda you will find in the solution.

If, as is reasonable to suppose, the object of the vital powers be the preservation of life; and as the first step towards the destruction of life is the disturbance or derangement of health, or of the *natural* condition of the living parts, it would be an inconsistency to infer that such a derangement can add to the *strength* or *power* of those parts. It may be said that health, in its most perfect state, consists in the highest power of vitality which the body can attain, and that any deviation from that state must be the effect of a diminution, and not of an increase, of the powers upon which the phenomena of life depend. Health, then, being the natural condition of a living part, must consist in, or be the result of, its most perfect vitality; and disease, on the contrary, being also a state or condition of living tissue alone, must depend upon some abstraction, or neutralisation, of the vital properties of the part. In whatever point of view we examine the subject, we cannot infer a disturbance, or derangement, of the vital properties of the vessels of a part to impart any addition to the powers of life in them. In consonance with these views, let us analyse the effects of mechanical violence on the vital properties of the capillary vessels.

There is no known reason why a blow, a puncture, or a cut should not act in a similar manner on the capillaries of all the tissues. Certain derangement takes place as a consequence; but as the cause is of a general, and not of a specific nature, it must be supposed to produce the *same kind* of derangement in all the vessels within the sphere of its influence, in proportion to the degree of force acting upon them: at any rate, we are acquainted with no reason why the effect should be otherwise.

But if such be the case, how are we to account for a degree of violence, in one instance, producing death, whereas, in another, no such effect follows, although the degree of violence, according to every proof, has been much greater? In one case, the effect may be erysipelas; in another, the formation of an abscess; in a third, extensive sloughing of the cellular tissue; in a fourth, gangrene of all the tissues of the part on which the violence has been exerted. In other cases, again, we find a mixture of these effects—we find erysipelas, abscesses, sloughing, and partial gangrene, all combined in the same limb. Now, the cause of this must be sought for in the constitution of the tissues themselves. As the mechanical violence is the same in all, we must look for the difference in the effect in the conditions of the parts which have suffered the injury; for it would be inconsistent with our knowledge of the operations of nature to suppose that the effect does not owe itself to some physical cause. This cause will be found in the difference of modification in the vitality of the part. For instance, the capillaries of one tissue may be in a state nearly, if not quite, healthy, while those of another, in its immediate neighbourhood, may swerve one or more degrees from that state. It is reasonable to suppose that the same degree of violence inflicted upon the two, in such different conditions, would produce different degrees of derangement of their

functions; and it, in fact, requires only this difference to stamp the character of the inflammation. The disease will put on characters according to whether one or more of the tissues suffer, and according to the degrees in which they respectively bear a part. The inflammation is, in general, a compound effect, proceeding from derangement of various tissues, and exhibiting, therefore, a mixed character; but it will also be considerably modified according to the grades of suffering of the different tissues.

It was the opinion of John Hunter, that the character of inflammation could not be determined by the tissue affected, otherwise we ought to expect various kinds of inflammation to take place in an amputated limb, because the knife cuts through all the tissues alike. The same reason has been often repeated since, by authors in support of the same opinion. Let us examine its force.

First, has it been *proved* that the same stump does not present different kinds of inflammation? On the contrary is it not a *fact* that different varieties of the disease are observed in the same stump? In a great number of amputations, the degree of vital disturbance is so small that not sufficient inflammation follows the operation to impart a decided character to the disease; but in those cases where, either from the violence of the injury which gave occasion for the operation, or from the peculiar modification of the constitution of the patient, inflammation is fully established, it cannot be denied that the disease frequently, nay, generally, does exhibit the mixed character resulting from the peculiarity of the affections of each tissue. So far as the skin is concerned, its vital derangement presents those distinguishing marks which characterise erysipelas. Its colour is of a bright crimson hue, like that of erysipelas; its redness disappears on pressure, as in erysipelas; and it has a tendency to vesicate, as it has in genuine erysipelas. In this respect, therefore, the inflammation, as it affects the skin, is of the erysipelatous kind from its commencement in a mere crimson blush, even to its highest degree, marked by vesication and death of the part. The subcutaneous or cellular tissue, also, puts on the character peculiar to itself while labouring under disease. If the inflammation be moderate, yet a degree above that which favours the exudation of the glutinous lymph, through the medium of which nature carries on the process of union, the cellular tissue gives exit to purulent matter, similar to that contained in the cavities of abscesses. In a higher degree of inflammation, the tissue shows its usual disposition to slough. As this tissue surrounds all the muscular fibres, inflammation of the muscles themselves will necessarily be modified by that of the cellular membrane which pervades, as well as envelopes, them. Indeed, we know but little more of inflammation of the muscular tissue than that the vessels of the muscles become fuller than in the healthy state, and that, in the highest degree of the disease, the blood stagnates in these vessels, and the tissue dies.

It follows, therefore, so far as our observations extend, that the

facts connected with inflammation proceeding from the amputation of a limb, are in favour of the view that the character of inflammation is determined by the tissue affected ; for we find the disease differently modified in every tissue ; and the modification observed in each tissue is similar to that resulting from the vital derangement of the same tissue under all ordinary circumstances.

In the second place, even if the characters of the inflammation, in alliance with the different seats, were not so uniform as they really are, other causes might tend to modify them, and render them unlike in different cases. As we stated before, one tissue may be in a healthier or more natural condition than another, and the several tissues may vary materially in their condition with respect to the natural and healthy standard. This variation may owe itself to some original defect of constitution, as scrofula, or other hereditary causes ; or it may have been brought about by causes acting during life, by their relations or affinities with particular seats. In cases of this nature, it is reasonable to infer that a tissue whose condition is furthest from the healthy state, would suffer most under the influence of the same cause. In other terms, the same cause, acting upon several tissues, varying in the amount of their natural vital powers, would affect those most whose powers are least—whose powers are lowest or most distant from the natural or healthy standard.

From the foregoing observations, it would appear that inflammation arising from external violence will be first, in a degree proportionate to the amount of that violence ; second, that it will be characterised according to the tissue or tissues upon which the violence has been inflicted ; and, third, according to the conditions, with regard to the amount of vital powers, of those tissues at the period of receiving the violence. Thus, a slight blow may cause inflammation so intense as to end in gangrene in a short time. We only know these conditions, or modifications of vital powers, from their effects ; but that they are dependent upon some peculiarity of the living tissues, is reasonable to infer, because the same mechanical cause—the violence—does not produce the same effect in all cases.

In the next place, we enter upon a consideration of causes whose nature is more hidden from our observation than that of causes connected with mechanical violence, namely, internal causes, or those whose relations with the vital tissues are of a more obscure character than the simple operation of external violence. The object of enquiry is the extent of our knowledge, or experience, respecting the influence of such causes in determining the character of inflammation.

Now, there exist certain facts connected with inflammation, which show that the varieties it presents are not accidental, but that they are determined by some physical causes which act similarly on all constitutions. Nothing can prove this point more satisfactorily than the circumstances attending *specific* inflammation, although differing in degree and modification in almost every case,

yet the general aspect of each species is so much alike in all, that the mind cannot reject the conviction that there exists a similarity of causes for the same disease in each individual. Whether we view the venereal inflammation, the scrofulous, the gouty, the variolus, or whatever other species of the specific kind, the prominent characters of each, in different persons, are so nearly alike, that the rational inference to be drawn from the phenomena is, that a similar cause, though differently modified in some respects, acts upon the same tissue in every case, though the tissue also may be modified differently in each. The condition of the tissues, as before observed, may either depend upon their original formation —upon an innate defect of vital energy in them—or upon a change having taken place during life, by the gradual operation of physical causes.

In illustration of the same properties in the animal body, we may notice the effects of different medicines. Medicine like the morbific poisons acts as a physical cause upon the vital structure. It is well known—indeed, this knowledge forms the very foundation of our practice—that almost every medicine acts specially upon some seat. That many substances exert, besides, some general action on the various parts is very probable; but we have sufficient proof that each bears a special relation to some seat more particularly than to any of the others. For instance, mercury exerts its influence more especially on the salivary glands; ipecacuanha on the nerves of the stomach; sulphate of magnesia on the mucous surface of the small intestines: opium on the brain, &c. In fact, there exists scarcely a medicine of any activity which is not well known to exert some special influence upon some particular organ or tissue: so that, in nineteen instances out of twenty, its effect in that respect may be depended upon. The same effect is produced whether the medicine be introduced into the body by the stomach, by injection into a vein, or by absorption from the surface: which proves that it is not the result of mechanical action or of local irritation simply, but that there exists a necessary relation or affinity between the properties of the medicine and those of the seat or tissue whose functions it modifies.

As medicines exert their influence upon some particular seats or tissues in preference to others, and as this effect is found to take place almost uniformly, even when they are administered to individuals differing in general habits and constitutions, it cannot but be inferred that the same tissues, in all individuals, possess a great similarity of properties, and that they are liable to be affected by the same causes.

Our knowledge respecting the manner in which medicines act on the different tissues, is not of that positive kind which will justify us in laying down practical rules; but we may be justified in inferring that other substances introduced into the system, though not coming under the denomination of medicines, will also act upon some seats or tissues rather than upon others. With the exception,

perhaps, of those substances which exert their influence directly on the nervous system, we know of no way in which medicines can act on the various parts but by being first conveyed to those parts in the common course of circulation. It will, probably, be said, that cathartics are also exceptions to this rule—that their action depends upon the irritation they are supposed to cause on the nervous membrane of the intestines. In support of such a supposition there is no proof. Indeed the proof exists on the other side, namely, that the ingredients first enter the circulating tubes, and are conveyed through the medium of the blood to the parts upon which they exert their influence, because, when injected into the veins, or are made to be absorbed from the surface of the body, they still act upon the same special seats as when applied directly to those seats.

It cannot be denied that the body is liable to imbibe various materials, from the external world, that bear injurious relations to it. Besides the stomach, into which matter in almost all possible modifications is received, at various times, the lungs, and the whole surface of the body, present a sufficiently extensive area for the admission into the system of morbific causes. The history of malarious diseases in all countries, and the facts which present themselves daily to our observation respecting the small-pox, and other exanthematous disorders, furnish abundant proof of the aptitude of the animal body to admit substances whose physical operations are injurious to its well-being.

Now, in every specific disease we find the same seat affected in almost all individuals labouring under it. Syphilis affects the tonsils first ; then the skin ; then the periosteum of the tibiæ. It might be asked, why does it attack these bones more than others ? The only answer we can give is, that these bones, or their periosteum, are differently modified from all the others, and that, consequently, their relations are different. If the periosteum of the tibiæ is modified according to its own kind, the vessels by which it is manufactured, nourished, and preserved must be also modified differently from those of the periosteum of the other bones, and must therefore, have their peculiar relations or affinities modified. Facts of this kind are not to be rejected because we cannot tell *why* they should be as they are, for we are equally ignorant of the "*why*" an acid should have the power of changing the properties of an alkali.

Again, variola, and other cutaneous diseases, intermittent and remittent fevers, &c., present the same leading characters in all cases. It is true that they differ materially in degree; but they affect the same parts and exhibit similar symptoms, in every case. In truth, were it not for this uniformity of character, we should have no means of knowing them to be what they are. It is the resemblance of the most prominent signs of a disease in all constitutions that enables us to distinguish one disease from another, and that forms the foundation of all classifications. Truly, in most of our nosological classifications, diseases are classed together which

have very few properties in common ; but that is not the fault of
nature but of art : nature is uniform in *her* operations, however
changeable art may be.

In well known and long observed specific diseases, whether
general or local, their identity is exhibited in all constitutions.
However various the modifications may be, still their prominent
characters cannot well be mistaken.   But affections of a more irre-
gular occurrence, and the causes of which are not so general in
operation throughout nature, do not present themselves to our notice
in the same definite and striking manner as those termed specific,
or even as those arising from epidemic or endemic causes.   In one
instance we find " spontaneous" inflammation take place in the foot;
another time in the leg ; another time in the knee ; in another case
a whitlow occurs ; in another a diffused inflammation of the
integuments of the face and head ; in another an abscess of the
liver ; a carcinomatous tumour of the breast; the development
of pulmonary tubercles, &c.   These, and numerous other affec-
tions not owing their production usually to causes acting upon
a general scale have been considered more obscure in their origin ;
and they have not been traced up to their sources, like those
dependent upon specific, or epidemic, causes.

But the question is, do these, or do they not, owe their existence to
physical causes, as regular in their operations, when applied to the
body, as those which give origin to syphilis, variola, intermittent
fever, or any well known malady ?   Are they the effects of real
physical laws, or do they break out " spontaneously" in the strict
sense of the term ?

We can form no idea of a change taking place in any part of the
body without its being brought about by something possessing a
substantive existence.   If a part is originally perfect, it must con-
tinue perfect, unless changed by the intervention of something which
bears an unhealthy or abnormal relation to it.   Let us suppose all
the tissues entering into the composition of the kindney to be in a
real state of perfection—that is, to be in a state of absolute health,
or possessing the highest degree of vitality of which they are
capable : we can form no idea of the organ changing from this con-
dition so long as the same causes which kept it therein continue to
operate.   It could no more start *spontaneously* from a healhy to a
morbid state, than a piece of chalk could transfer itself spontaneously
into plaster of Paris.   In both cases there must be the interposition
of some new ingredient, which, by playing its part as a cause, serves
to modify the properties before connected with the body.   In the
case of the piece of chalk, there must be the interposition of sulphuric
acid, which destroys, or considerably modifies, all the properties
which the chalk possessed, and gives existence to others possessing
new characters.   In the kidney, the change must be analogous from
the really healthy to a morbid state.   Some physical cause must
interpose its properties, and thereby modify those of the organic

tissues, so as to reduce the quantum of their vitality below the degree which marked it before.

The same principle will apply to every tissue in the body. When its condition is changed, the change must owe its existence to the intervention of a new cause.

As the blood is the common pabulum for the supply of all the tissues, it is very probable that it is also the vehicle which conveys substances deleterious to those tissues; and that the relations of substances, so conveyed, are formed in the different seats, in the manner found to take place in specific diseases. They may pass through the capillaries of various seats without disturbing their functions, or producing any derangement of their vital properties; but when arrived at a seat with the properties of which they bear such a modification of affinity as to excite a disturbance of their vital arrangement, the vessels of that seat—being the labourers by means of which the material fabric is kept in repair—loose a portion of their vitality: in other words the vital properties are changed; their contractility is diminished; their calibre is increased, by virtue of their innate elastic power; the velocity of the blood through them becomes less, although the quantity existing in them is greater, than natural; all the phenomena of inflammation take place differing in degree according to the scale of vital derangement, and in modification according to the tissue affected, and its condition in relation to the healthy standard at the time of the action of the cause.

From the view we have taken of the morbific cause of inflammation, there exists no necessity for assigning any mechanical obstruction to the capillary tubes. M. Magendie in the last of his very interesting lectures,[1] appears to attribute the origin of common inflammation to obstruction, as many pathologists did before. It cannot be doubted that the microscopical appearances of a part commencing to inflame, are such as might be expected to show themselves from obstruction in the capillary tubes. The motion of the blood, at a certain point, diminishes so much as to give the appearance of its being obstructed in its passage. The vessels, at the same time, increase in fulness and redness; and these appearances extend rapidly to the neighbouring tubes, as if the fluid were driven in torrents to the collateral channels in consequence of obstruction to its natural course.

But a moment's consideration must satisfy us, that a mere mechanical obstruction in a capillary tube cannot occasion the phenomena just described. We do not find such an effect follow the tying of a larger branch, where complete obstruction is produced. The blood directs its course, or its course is directed, to the collateral branches, without occasioning any disturbance in these branches resembling inflammation. The collateral tubes very soon adapt their calibre to the additional quantity of blood sent into them,

[1] Published in the Lancet.

and no functional disorder takes place. Now, if an obstruction of a considerable arterial branch may be produced with so little disturbance to the circulation, and if the subsidiary branches so readily adapt themselves to the additional duty imposed upon them, of giving transit to an increased quantity of blood, it would be almost an absurdity to suppose that the mere *obstruction* of a single capillary tube could give rise to phenomena like those of inflammation, where myriads of collateral tubes surround it on all sides. It is probable that fifty anastomosing ramuscules would join within the fiftieth part of an inch of any part in a capillary tube where the molecular obstruction might be supposed to occur; and amongst so many channels of conveyance in the immediate neighbourhood, any obstruction of a single tube, or of fifty tubes, would create little disturbance to the circulation.

The only manner in which an obstruction can be supposed to cause inflammation is, not by acting mechanically in blocking up the passage of a capillary tube, but by the deleterious relation subsisting between the obstructing object and the coats of the vessel, thereby giving rise to a disturbance, or in more common terms, producing *irritation*, of those coats; the necessary consequence of which irritation or vital disturbance is the abnormal dilatation of the obstructed vessel, followed by the other phenomena of inflammation. Whether inflammation ever originates from such a cause, can be a mere matter of surmise. If the affirmative opinion be adopted, we must also adopt the doctrine of *error loci;* for it is evident that the moving molecule could not become impacted unless it entered a tube too small to permit it to pass through. However, the being obliged to admit such an opinion is no reason for rejecting a fact, provided the fact itself has been proved.

The microscopic phenomena observable in a point commencing to undergo the process of inflammation, are so like those which might be expected to arise from obstruction, that it is not to be wondered at that they should have been mistaken for those of obstruction, by pathologists who entertain the common notions of inflammation. The first sudden application of a stimulus, whether to the web of a frog's foot, or to the capillaries of any part of the human body, causes, perhaps in all instances, for a moment, an unnatural *contraction* of the vessels; but this momentary contraction is succeeded by a preternatural dilatation, and by a diminished velocity of the blood within the tubes. Whether the momentary increase of the contractile force be an effort to resist the influence of the deleterious cause, by inducing the vessels to draw their parts together into the smallest compass, and to condense their properties into the most compact state, may be a matter of dispute, but it is indisputable that the vital powers are soon subdued, and that the preternatural contractile efforts are immediately obliged to succumb to the influence of the morbific cause.

As soon as the vessels begin to relax, after the application of a stimulus, whether that stimulus be the prick of a needle, or some-

thing else applied to the vital part, the motion of the blood imme-
diately diminishes, and the fluid appears to the sight as if something
obstructed it in the tubes. As the vessels continue to enlarge, the
velocity becomes less ; and as the enlargement extends by continuity
to the neighbouring capillaries, the part puts on an appearance as
if the blood rushed into the collateral branches owing to an
impediment to its course in one of the canals. It is evident that all
this appearance cannot take place from the stoppage of one tube
among a million—that such an accumulation of blood, and such
intense redness, cannot owe their existence to such an insignificant
impediment in the middle of so wide a channel. On the other hand,
an appearance like that described must be the natural consequence
of an inordinate expansion of the capillaries extending from a single
point.

Admitting the facts adduced in the present section we may be
permitted to conclude,

1. That the most prominent characters of inflammation are
dependent upon the tissue affected.

2. That every variety of inflammation—in other words, that in-
flammation of each tissue—is modified considerably according to
the nature of the cause producing it.

3. That every variety of the disease is also modified according to
the condition of the tissue affected.

4. That every variety is likewise modified according to the
general condition of the system ; which, of course, embraces the
condition of each tissue.

5. That the same cause may produce more than one variety of
the disease, by acting upon more than one tissue.

6. That the nature and properties of each tissue are determined
by its nutrient vessels.

7. That the vital properties of the nutrient vessels are differently
modified in each tissue, so as to suit them for the special purposes
of the tissue.

8. That, therefore, the vessels of all the tissues are liable to be
affected somewhat differently, and in a different degree, by the same
cause.

Condition of the Blood in Inflammation.

In the lectures to which an allusion has been made, M. Magendie
seems to attribute inflammation in general to the condition of the
blood alone. His views are founded upon experiments of whose
correctness we entertain no doubt ; but the conclusions which he
draws from them are remarkably worthy of doubt in a practical
point of view.

The facts are, that defibrinised blood or blood whose fibrine
is deficient in proportion to its other ingredients, is liable to, and
generally does exude through the coats of its vessels in different seats,
and gives to these seats, when examined after death, the appearances

of being in a state of inflammation. Also, that some of the tissues of an animal whose blood has been defibrinised are subject to redness and ulceration.

Now, with regard to the redness observable, on *post mortem* examination, in animals whose blood has been defibrinised, it cannot, if dependent on transudation of the blood, as we believe it is, bear any analogy to inflammation. The redness is, probably, the only element of inflammation existing. As the morbid appearance depends upon a cause similar to that which gives rise to the ecchymosed spots of scurvy, of petechiæ or the livid spots which often take place in those who have been long confined in jails, there is reason to infer that the exudation is unattended both by *heat* and by *pain*. With regard to the *swelling*, it can amount to no more than what depends on the quantity of fluid extravasated, for the blood is deficient in that very ingredient to which the permanent swelling of inflammation is owing, namely, fibrine.

But it will be said that ulceration takes place, and that ulceration cannot occur without inflammation. If it be insisted on that the ulcerative process can in no instance go on without being preceded and accompanied by inflammation, then it must be admitted that the morbid appearances observable in animals whose blood has been deprived of the greater part of its fibrine, are those consequent on inflammation. But it would be almost as reasonable to insist upon every function in the body to depend upon an inflammatory operation, as to insist upon ulceration being so in every instance. In instances of emaciation from want of food, there is a removal of structure upon a large scale, but no one will attribute it to an inflammatory process. There is an instance recorded where the stomach consumed a portion of itself after death. It is presumed that it will not be insisted on, that the process here adopted by the self-consuming organ was that of inflammation. The ulceration which characterises a chancre is often unattended by the least appearance of inflammation. If these facts be admitted, it is possible to account for the ulceration of some of the tissues in animals whose blood has been defibrinised.

When the blood has been defibrinised, it must, of course, be in an abnormal state. This alone would render it unfit for the numerous transformations which it is intended to undergo in the various structures. But, deprived of its fibrine, it has lost that very quality by means of which, principally, the structure of the body is renovated after the removal of the old materials. Absorption goes on, but the renovating elements are wanting, so that the secerning function is at a stand still. The absorbing process, no doubt, exceeds the secerning in all parts of the body, so that there is a universal course of *emaciation* going on in the system: but the privation does not show itself in the form of *ulceration*, except in parts void of epidermis. From the softness and sponginess of the mucous membranes, they are the most likely to be the first to put

on the appearance of ulceration in consequence of the excess of absorption over the renovating process.

We have observed frequently before, that nature has implanted an innate disposition to self-preservation in all bodies. As the blood is the common pabulum from which all the structure derives its renovating elements, and, consequently, upon which the maintenance of the whole fabric depends, it is probable that, in cases of accident, or where artificial means have been used to deprive it of an essential property, the vital efforts of the whole system would be directed towards restoring to it that property. Why does nature shoot out roots from a willow branch stuck in the ground? Why does she restore the head of a snail? the arm of a newt? why heal a wound? restore a piece of nerve? unite a fractured bone? The *why* of these things we are not able, and never *shall* be able, to find out, although we may discover the processes employed for bringing about the effects. The blood being one of the most essential agents for the preservation of the animal, the absorbent functions, in cases of defibrination of the fluid, may assume an action sufficient to take up a part of the fibrine already laid down in the form of structure, in order to restore its lost quantity to the common pabulum.

But that the condition of the blood exerts an influence on inflammation, is highly probable. Indeed, we are not acquainted with any mode in which the morbific cause of the disease can find its way to the different seats except through the medium of that fluid. Whether the original application of the poison be to the stomach, to the lungs, or to the surface of the body, the vehicle by which it is conducted to the various seats must be the blood. As this is the case, it must follow that this fluid is liable to deterioration of properties, like the solid structure; for every thing which is calculated to reduce it to an abnormal state must be injurious to it as a vital agent.

It is a question well worthy of consideration—but one which can only be satisfactorily decided by experiments founded upon a more correct knowledge of the chemical and vital properties of the blood than at present possessed—how long the morbific cause of disease may exist in the mass of blood before exerting its affinities and exhibiting its effects on the solid parts? As a second part of the enquiry, it would be desirable to determine how long, if any time, after having acted in a way to produce morbid symptoms, the morbific cause continues to exert its influence on the seat of disease?

That the morbific cause continues, in some instances, to circulate for a considerable period in the mass of blood, before imparting its deleterious influence to the solid structure, is probable, from some facts connected with the origin of certain diseases. For instance, in intermittent and remittent fevers, the noxious vapours are frequently in connection with the body for a considerable period before the disease developes itself. Some constitutions suffer sooner, and some later, proving that those who suffer last were exposed to the

morbific cause from the first, equally with those in whom it pro-
duced a sooner development of the malady. From this circum-
stance, it is not improbable that a certain quantity, or a certain
density, of the cause is necessary before the vital properties of the
structure can be made to submit to its influence. As those proper-
ties differ in their degree of vigour in different constitutions, as
numberless facts go to prove, one person may so far resist the ope-
ration of the cause, as not to present actual symptoms of disease,
twice or three times as long as another, though, doubtless, some
portion of the power of the system has been abstracted by its
influence before the actual breaking out of the malady, or before
disease manifests itself by symptoms.

If the blood can become loaded with morbific poison, and remain
so for some time previous to the development of disease, it is rea-
sonable to suppose that it may continue to retain the same noxious
cause after its effects have shown themselves in connection with
the solid structure. During the continuance of the exposure to
the same deleterious influence, the body must go on receiving new
portions of the same poison, and, of course, the blood cannot purify
itself of it while the external circumstances continue unchanged.

It will perhaps be asked, if such be the case, how is it that the
system ever rids itself of the noxious influence while remaining in
the same locality? As it is a *fact* that it does so—that intermit-
tents and remittents get well of their own accord, in localities and
at periods where and when others are falling under the influence
of the malaria—it must follow that the system is endued with some
inherent power of relieving itself from the effects of the poison.
It is evident that the restoration of the vital power is not dependent
upon the removal of the cause which first produced the disease,
because the same cause still continues in operation, as proved by its
action upon others; but it is equally evident that the morbid rela-
tions of that cause with the vital parts have changed, otherwise
the effect must still continue the same as at first. It follows, there-
fore, that the change which has rendered the operation of the poison
innoxious, must have occurred in the system itself.

The only mode in which the living parts can be supposed to
have acquired a new power of resistance, is by modifying their
properties in such a way as to render themselves proof against the
affinites of the morbific agent. A power analogous to this seems
to be inherent equally in animals and vegetables, by means of which
they are able to neutralise themselves under external circumstances
foreign to their original habits and conditions.

But that the cause, which originally gave rise to the disease, fre-
quently continues to exercise its influence upon the body long after
the development of the malady, is proved by the recurrence of the
paroxysms of intermittent and remittent fevers. The former of
these will often keep on long after the removal of the subject of it
from a repetition of the influence of the original cause—that is, the
action of the poison.

Now, the principle which applies to the operation of a general morbific cause, will apply equally to that whose sphere of action is more limited. It probably seldom happens, in cases of local disease, except where mechanical or chemical violence has been applied to a part, that inflammation is set up by one application of the cause—a single dose of poison—to the tissues whose vital properties are disturbed.

We have already endeavoured to prove that such a thing as "spontaneous disease" can have no existence, and that diseases whose causes are not capable of being visibly shown are still the effects of causes not less physical in their nature. We have also shown it probable that the blood is the common vehicle of morbid poisons, as well as of nutrition. These points being admitted, it may also be readily supposed, considering the circumstances attending the operation of endemic causes, that the blood may long continue to hold in suspension, or in union, a quantity of the same morbific elements which gave rise to a local disturbance, after the first development of the inflammation. If this be the case, we may account for the obstinacy in some cases, and the rapid progress in others, of the inflammatory process; because the seat of disease receives an incessant supply of the same elements which first produced the vital disturbance. We may illustrate this point by the circumstances attending hospital erysipelas, and, indeed, erysipelas in general, as well as peritoneal inflammation, especially of the puerperal kind. It is probable that most of the eruptive inflammations are supported in an analogous manner, until their term of existence has become extinct, from exhaustion of the poison which gave rise to them, or from its emission from the system.

In inflammation of any extent, the blood, when taken by venesection, puts on a well known appearance, called the "buff-coat." This appearance is considerably modified by the manner in which the blood is abstracted; by the shape of the vessel into which it is received; by the quantity drawn into it, and by various other causes. Although the firmness of the coagulum, and the thickness of the buff-coat, differ in degree according to the above causes; and although the blood sometimes does not show any of these appearances in inflammations of some magnitude, yet they are so generally attendant on it, that it is not easy to dissociate the idea of a necessary connection between them.

The buff-coat is nothing more than a layer of fibrine, but why, or owing to what physical properties, it separates itself from the other ingredients of the blood in cases of inflammation, in cases of pregnancy, &c., it is not so easy to determine. Merely to state the fact, that the coagulation forms more slowly in these cases than during the normal state, so as to allow more time for the red globules to subside before they are entangled in the meshes of the fibrine, will not account for the physical cause of the difference in the quality of the fluid; for it may be demanded, *why* does the blood coagulate less quickly in inflammation than when taken from

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a healthy body? But, in truth, it may be much doubted, until further observations on the properties of the blood be made, whether, as a general rule, the process of coagulation be slower in cases of inflammation, than those where that disease does not exist. That it sometimes proceeds very rapidly, is a fact well established by observation.

To discuss this subject so fully as it merits, as a general question, would occupy more space than can be here allotted to it; but it may be suggested as probable, that the firmness of the coagulum in these cases bears some ratio to the reduction of the vital properties of the blood, either by the influence of the morbific cause of the disease, or by the abstraction of the red globules by venesection.

Where the disposition to form the buff-coat exists, if any number of portions of the same blood be drawn at the same time into different vessels of the same shape and size, the consistence of the cake will, in general, be found to vary in them all. The quantity of serum expressed, and the density of the coagulum, will be least in the portion drawn first, and both will increase in the order in which the different portions were abstracted. But this will only hold good as a general rule, for the visible qualities of the blood sometimes change so suddenly as to render it difficult to assign any physical cause for the alterations. Blood abstracted during the cold stage of an attack of inflammatory fever will often not present the slightest appearance of buffiness, whereas another portion drawn an hour afterwards will be as buffy as any inflammatory blood. On the contrary, inflammatory blood will sometimes cease to be buffy after the first or second bleeding, though by far more commonly this quality increases in proportion to the quantity abstracted.

It may be also noticed, as a general rule, that the thinner and more emaciated the patient is, the denser, and generally the quicker, the coagulation will be. In such constitutions, the blood presents the appearance of buff in the most trifling cases of inflammation; whereas in strong, robust, especially fat, individuals, the fluid often exhibits hardly any buffiness, even in severe cases. The buff, as by far the more general rule, bears an inverse ratio to the vital powers of the system.

It may be asked, why should the blood exhibit the buffy quality in cases of pregnancy? There is here no inflammation—no abnormal condition of the system—for pregnancy is as much a natural process as the digestion of the food or the contraction of the heart. But, during pregnancy, there is a new and additional draft upon the constitution set up. The vital powers of the mother are obliged to be divided between herself and her child. There is an abstraction of the natural quantum of blood from her, by the amount which goes to nourish her progeny. The effect of this cause upon the condition of the blood appears to be similar to the abstraction of a part of it by venesection—that is, the removal of a portion of the red globules from her system, so as to cause a disproportion between them and the more fluid part of the mass.

These statements contain nothing more than the general facts; the physical causes upon which the effects depend ought to be traced, both by experiments and by inferences founded upon those experiments, much more minutely than they have hitherto been. As there are many grades between the effects observable in the blood, and *first* causes (into which it would be useless to enquire,) there is here a field, sufficiently wide, open for research.

In the mean time, it may be suggested as probable, that the coagulation of the blood is a *vital* process: that it is the last effort of the fluid to retain its identity, by drawing together into the smallest compass of which its forces are capable, those ingredients in it—the red globules and fibrine—in which reside the properties most essential to its character as living matter. If deprived of this last resource for some time after being drawn from its natural habitation—the channels in which nature destined it should live—it entirely loses the coagulating property, and no power with which we are acquainted can restore that property to it.

Influence of the Nerves in Inflammation.

It appears to be the opinion of many, perhaps the greater number of physiologists, that the nerves are the sole agents of vitality. If that be the case, they must also be the sole subjects of disease; because nothing but a living tissue can be liable to disease. The nerves and electricity are the two most convenient agents in nature, for the former will enable us to account for all the otherwise unaccountable phenomena in the animal body, and the latter will readily supply the defect of our knowledge respecting the rest of the material world. So useful and accommodating, indeed, are these two agents, that, in the absence of the one, the other, under the direction of some expert *savans*, has been made to supply its place. As a muscle will not move, and a gland will not secrete, when their nerves have been divided, the whole of each function has been attributed to these agents. But it happens, also, that neither muscular contraction no secretion will be performed if the *arteries* of the muscle or of the gland be entirely obstructed. As a crowning proof, not only that the nerves and electricity are almost almighty agents, but that they are also identical, a muscle has been made to move, and secreting surfaces have been made to throw out fluid, by the application of electricity alone, after the presiding nerves have been divided. But it happens that the prick of a needle will produce the same effects. Will electricity cause the secretion of gastric juice, or any other juice, ten hours after death? or will the two agents combined move the fibres of a muscle at the end of that period after the heart has ceased to act?

But, although the nerves do not constitute the *whole* animal economy, still it will not be denied that they act an important part in it. When the combined acts of many agents are necessary to the performance of the functions of each, it becomes difficult to determine how much is due to one, and how much to another.

Now, it is impossible to separate all the nervous fibrils from the rest of the structure; it is therefore impossible to *prove* that a vital part would retain its life *for any time* in the absence of *all* nervous influence.   We do not *know* that the nerves impart *no* properties to, and exert *no* influence on, the rest of the structure, after their communication with the brain has been cut off by division ; but we know the fact, that a part will live, and that the blood will circulate through it, after the nervous communication between it and the brain has been destroyed.   We know, also, that the visible phenomena of inflammation may be produced in a part so circumstanced —that, upon the application of stimuli, its vessels will expand, and admit more blood than they contained before.

But, as might be expected when we consider that the vital phenomena are dependent upon the combined operations of all the functions, the power of maintaining its vitality by a part deprived of its nervous communication with the brain has its bounds.

If the ischiatic nerve of a rabbit be simply divided, although its ends retract about the eighth of an inch, yet a union is very soon formed by the production of new matter.   It is several weeks before the animal recovers its feeling, and gets rid of its lameness, but the nervous influence is sufficient to secure the vitality of the part.   But if a considerable portion of the nerve be cut out, or if divided and its ends be placed in such positions as to prevent their union, the limb will generally slough in a week or ten days.   The circulation in it will go on, apparently, tolerably well for a few days, but when it once begins to slough, the sloughing proceeds most rapidly, so that, in the course of two or three days, nothing but the bones and tendons remain.

These facts prove two things: first, that vitality continues in a part, and that its vessels will perform their functions, although its nervous communication with the brain be cut off; and, second, that the organic life of the arteries is not dependent upon the ramifications of ganglionic nerves following the course of the vessels from their origin in the chest and abdomen, as supposed by some physiologists; because, if so, there is no reason why the limb supplied by vessels so vitalised should die.   If it be maintained that the (supposed) organic nerves are contained in the same sheath with the ischiatic nerve, then it is evident that they are not the agents which confer vitality upon the arteries and the mixed structure, for both the arteries and the other structures continue to live for several days after the sheath has been divided.

But that the nerves bear an essential part in the process of inflammation, is evident from the pain which usually attends the disease.   As they are the sole agents of sensation, so must they be the media which acquaint the seat of sensation of the vital disturbance going on in a distant part.   Moreover, the nerves, like all the other tissues, are preserved and renovated by the agency of the arterial extremities, and the elements upon which their very existence depends are regularly supplied to them from the common

pabulum. This furnishes the materials upon which the vessels exert their vital powers. Being thus dependent upon the due performance of their functions by the capillary vessels, it must follow that they suffer, like the other tissues, when these functions are disturbed.

PART II.

SURGERY.

GENERAL REMARKS ON LOCAL THERAPEUTICS.

The principle of the division of labour is carried to a considerable extent at the present day in all departments, and we are not aware that harm can arise from it in the medical profession, provided the members of that profession be originally well grounded in a knowledge of its general principles. In the surgical department, certain dexterity will be acquired by constant practice, which will give the possessor of it an advantage, in intricate operations, over those who are less often called upon to exercise their manual skill. This manual tact, however, is less required in modern times than formerly, for, happily, the application of a more correct knowledge of the principles of disease, and of the properties of therapeutic agents, to the removal of local affections, have rendered the employment of the knife seldom necessary now, compared with the frequency of its use some half a century ago. It must be considered, also, that the division of labour in the medical profession, however unobjectionable in itself, can only be applied to a small portion of the community—those inhabiting large towns—for the greater part must always rest satisfied with deriving the benefit of both medical skill and manual dexterity from the same individual.

But the grand principle, which should never be lost sight of, is, that disease is the same in its nature whether situated externally or internally. The first question to be determined is the seat of the malady; and the second is, in what manner is that seat affected? With regard to outward affections, we have the advantage of the direct evidence of our senses, which, combined with our previous experience, will give us at once a tolerably correct knowledge of of their visible characters. We are capable of examining the condition of the part affected by the medium of the strongest evidence we can possess, and, therefore, except in instances of extreme ignorance, the two first difficulties, compared with internal diseases, are got over with satisfaction.

But, however simple this part of the business may appear, still, in order to turn our examination to practical use, it is necessary to know something more than that the leg is the limb affected, and

not the arm; that the part is red, not pale; that it is hard, not soft, &c. These, truly, are facts with which it is necessary to be acquainted, but they may be acquired as well by the most ignorant as by the most renowned surgical practitioner. He who is unacquainted with the properties, both natural and pathological, of the blood-vessels, and with the characters of diseases as they affect the different tissues on and near the surface of the body, may exercise his senses as long and as intensely as he please, without being able to form any rational idea of the nature and tendency of the malady.

If the disease be the same in its nature, whether occurring in the interior of the body, or on, or near, its surface, it will appear clear that those remedies which are calculated for subduing internal affections may be usefully employed in external diseases. In outward diseases we possess the further advantage of being able to direct our remedies to the immediate seat of the malady.

Now, it may be asked, in what manner do external remedies act in subduing disease? Before the question can be answered, it is necessary to say a few words respecting the nature of different diseases.

In every tissue of which the body is composed, there are certain processes unceasingly going on towards the preservation of its vitality and the maintenance of its structure. The first of these is the essential one by means of which the molecules of matter are deposited, and which is usually called the secerning process. The absorbent process may be considered in some degree as the opponent of the former, although in the healthy state, they rather succeed than oppose each other. Into the nature of that influence which the nerves exercise in these operations it is not our intention to enquire here, but that the three functions are essential to each other, is well known and generally acknowledged. Whether there be distinct vessels from the arteries themselves whose office it is to secrete, and distinct vessels from the veins whose office it is to absorb, is a subject foreign to our present enquiry; for the action of therapeutic agents may be equally accounted for according to either opinion. In health the two functions bear a certain ratio to each other. Those particles which are deposited by one set of vessels, are removed in their turn by another set, and an equilibrium is kept up. But during the progress of disease, this equilibrium is destroyed, and it is worthy of special consideration that the preponderance is almost always on the side of secretion. It is seldom that the diseased part is removed by absorption, for when destroyed by ulceration the process is generally that of gangrene or sloughing, which is a destruction alike of all its vital properties.

Whether the secerning vessels be a class distinct from the arteries, or whether the secerning and secreting functions be carried on by the capillary extremities of the arteries themselves, it is highly probable, as they are the agents which lay down the materials of all the structure, that they are implicated in every derangement

which takes place in any of the tissues. As, also, the elements of all the tissues are derived from the blood, which must pass through the capillary extremities of the arteries, the secreting vessels, if not these capillaries themselves, must be continuous with them, for the particles which constitute the structure must have traveled through both.

We have stated that when a part is undergoing disease, the secreting function generally overcomes the absorbent, which causes a preternatural deposite of matter. This is usually the first step towards the disorganisation of the structure. The question to be now considered is, how does this condition of the part happen? It may, and probably generally does, owe itself to causes: first, in consequence of the vital derangement of the capillary or secreting vessels, the calibres of these vessels enlarge, so as to enable more than the due proportion of fluid to pass through them; and, in the second place, as the absorbent function is the reverse of that of secretion, and must be performed by a *different* class of vessels, a similar derangement and relaxation must diminish their force, and thereby render their function *less* active than natural. For instance, if the vital derangement of the capillary extremity will cause this extremity, in consequence of its preternatural enlargement, to deposite *two* atoms in the time it could only deposite *one* in its natural state, it does not follow that a similar enlargement of an absorbent vessel, to whatever class it may belong, can *take up*, and transmit, twice the number of atoms in the same time. On the contrary, any loss of contractile power in the absorbents, (or the extremities of the veins, or imbibing pores, or whatever the nature of the absorbing apparatus may be) must render their function less active than it is in their natural state.

If the preceding view be correct, it follows that the same morbific cause which is calculated to *accelerate* the secreting function, has also a tendency to *reduce* the activity of the function of absorption. As in all cases of local inflammation the dimension of the capillaries is considerably increased, they have a morbid necessity of depositing more than the natural and healthy quantity of materials in the seat of disease; and as, on the other hand, the force of the absorbent vessels is diminished by the same cause, the inevitable consequence is, first, a simple swelling, and, ultimately, an organic change of structure.

As this is a subject of considerable importance in its bearing upon the principles here insisted on, we may be permitted to dilate a little on it, even at the expense of repetition.

Whatever the nature of the morbific cause of a local disease may be, one necessary consequence of it is a derangement of the vital functions of the part upon which that cause acts. If the cause be external violence, the texture of the structure may suffer at the same time that its functions are disturbed. In the next link of the chain of causation, a development of morbid phenomena occurs. The part becomes red, hot, swelled, and painful. In a word, it becomes *inflamed*. In some—indeed, in many—instances, when

the cause is conveyed through the medium of the blood, or when the disease arises spontaneously, (as the term is,) the derangement is so slight, or the nature of the tissue affected is such, that the symptoms of the malady are not of that degree as to bring them within the common acceptation of the term *inflammation :* still the operation of the cause is the same in kind, that is, the immediate effect is a derangement of the functions of the part affected. The first train of morbid phenomena having become developed, these phenomena may go on increasing; or they may remain nearly in the same degree, although, from their existence alone, the sensible change of structure must continue to increase; or, lastly, they may disappear, so that the part affected returns to its normal state. If the last condition should take place, it is a proof that the morbific cause has ceased to act, either from its having been removed, or from the tissue affected having become so changed in its modification as to be no longer sensible to its impression. If the morbid phenomena continue in the same state or degree, the original cause of derangement may be still acting on the seat of disease, or if removed, the derangement caused by its original relations may be of that kind and extent as to render it difficult for the part to return to its normal state by the mere effort of nature. Moreover, while in this condition of preponderance of one function over another, although the morbid phenomena may be moderate, still, as a preponderance does exist, great organic changes may take place in the tissues involved in the disease. Should the morbid phenomena continue to increase, there must either be an accumulation of the original cause in action, or the first derangement in the vital functions of the part affected must have been of a nature to act as a cause for further vital derangement, and thus proceed towards disorganisation, by every step or degree of derangement acting as cause for derangement further on in the scale. It is probable that this is the mode in which disorganisation takes place in most cases of gangrene, especially in those following inflammation resulting from external injury; for in such cases there can be no specific cause in operation.

It may be said that the morbid phenomena in all local diseases are analogous to those which characterise inflammation. That term is applied to them in different degrees or modifications, but these degrees or modifications are entirely dependent upon the tissue affected, upon the condition of that tissue at the time in relation to its natural state, and upon the nature of the cause which acts upon it and gives existence to the disturbance. As the properties of the arterial extremities vary almost without end in the different tissues, which tissues, also, are almost innumerable in variety, it is no wonder that their derangement should lead to organic changes so different in their character. According to the modifications of these properties in the different tissues, we have simple inflammation, which, according to its degree, may end in resolution, or in the destruction of the part; we have a purulent abscess; a cellular deposite of coagulable serum or lymph; a mellicerous

deposite; a steatomatous tumour; a sarcomatous tumour; a carcinomatous induration, and numberless other preternatural formations, but it is evident that in all these cases the deposition of materials predominates over the absorbent function, and the preternatural deposite is determined according to the peculiar modifications or properties of the vessels in the tissue specially affected.

Such being the condition of a part undergoing the process of disease, it is clear that the grand principle of therapeutics must consist in the means of restoring its natural functions—in restoring the equilibrium between the functions of secretion and absorption. Whilst the morbific cause continues in operation, this cannot be done; it is therefore a matter of necessity to remove that obstacle before a cure can be accomplished. But what do we know of morbific causes? We know but little, it is true; but, experience, and a collection of facts, assure us that certain articles possess the power of subduing diseases, and that the same articles will *generally* subdue diseases presenting similar phenomena in different individuals. It is true that we know but litttle of the cause abstractedly, but we distinguish its effects in relation with the visible structure, and from these effects, or morbid phenomena, we form our judgment of remedies which experience has proved to be capable of their removal. We are also able to draw some inferences respecting the manner in which these remedies accomplish the removal of the morbid symptoms.

Abundant facts, within our experience, prove that living parts are endued with an innate tendency to relieve themselves from the operation of disease, provided the exciting or morbific cause be removed. If this were not the case, it is difficult to account for the restoration to its normal state of an internal part which has undergone the process of inflammation; for internal remedies can do no more than neutralise the morbific cause, and the vessels must recover their vital contractility by some inherent properties connected with their own coats. Whether we consider bleeding, which, in addition to relieving the general vascular system, may be the means of abstracting a portion of the morbific poison; or purging, which may expel it by secretion and excretion; or sweating, which may act in a similar way; or specific remedies, which act by neutralising the poison in the system—whether we consider one or all of these, we can only suppose them capable of removing that cause which first gave being to the vital derangement, and the vessels are left to the *vis medicatrix*—to the vital properties of their coats—to recover their lost contractility.

Now, in external diseases, we have all the remedial means within our power which apply to the subduction of internal maladies, with the addition of remedies calculated to restore, by direct application, the vessels to their normal state and to re-establish the equilibrium naturally subsisting between the two opponent functions of secretion and absorption. There is no doubt that chronic diseases depend, in the great majority of instances, simply upon the non-recovery of their contractile properties by vessels whose vital derangement was

first occasioned by an exciting cause. Frequently, the innate vital properties of the vessels are sufficiently powerful to restore them to the state of health when the excitement is over; but such is not always the case; and the disproportion between the secreting and the absorbent functions continues, thereby giving rise to new formations, differing in their characters according to the causes already explained, namely, the nature and condition of the tissue immediately affected, and the morbific agent which first produced the vital disturbance.

Disease manifests itself by a combination of phenomena which vary considerably in their relative degrees in different cases. In acute inflammation, they exist in certain proportions, which, for the purpose of illustration, may be considered as a standard. We have here, pain, heat, redness, and swelling, in given proportions, and these morbid phenomena in combination according to such proportions constitute the sum total of the inflammation. But, as before stated, these proportions vary in different cases. The redness, for instance, may be intense, still the temperature of the part may be even below the natural standard; or the pain may be almost absent in a part which presents both redness and swelling; or the pain may be severe without increased heat, redness, or swelling sufficient to enable us to distinguish any difference between the seat of disease in that state and its natural appearances. All these differences exist even in the incipient stages of the affection, but they generally become more striking as the disease advances.

As the predominance of morbid action is on the part of the secreting function, the effect of the derangement usually is the deposition of new substances, which become organised in their turn, and which permanently alter the character of the original seat of the malady. These formations, as already observed, will have their characters stamped by the immediate tissue in which the disease originated; or, more properly speaking, by the peculiar modification of the arteries supplying that tissue. In one seat the deposit will be steatomatous; in another carcinomatous, or mellicerous, or mere induration from simple lymphatic deposition.

It is evident that, in all cases of this nature, the equilibrium naturally subsisting between secretion on the one hand, and absorption on the other, is destroyed, and that, generally, the disease must go on continually adding to the original quantity of morbid secretion. The vessels of the preternatural growth—which growth was commenced by vessels whose natural vital functions had been disturbed by a morbific agent—are, like those of every tissue, modified in a peculiar way according to the structure which they are destined to supply; and by this modification the identity of the new growth is preserved and nourished, in a manner perfectly analogous to the preservation and nourishment of all the natural tissues of which the animal body is composed. In this stage, the disease has assumed a character perfectly different from that which constituted it at its origin, and which consisted simply in derangement of the vital functions of the capillary extremities: in fact, the

effect of the vital derangement—that is, the morbid deposite—has become the actual disease, and this disease has permanently established itself as a part of the living structure.

Supposing, then, in the incipient or early stage of local inflammation, the original morbific agent to have ceased to act, or supposing the inflammation or vital derangement, to have been the result of some external injury, the object is to restore the disturbed and weakened vessels to their original state. But, how is this object to be accomplished? What have we to fight with? The answer is, we have superabundant heat, pain, preternatural redness, and some degree of swelling.

Now, our knowledge of means capable of removing these morbid phenomena depends entirely upon observation and experience. But our knowledge in this respect is precisely the same in *kind* as that which informs us that an acid will change the properties of an alkali; for, in both cases, the result is anticipated from a similar result having been observed to follow the application of the same causes in a number of instances. If an evaporating lotion has been observed to subdue inflammation in a considerable number of cases, the mind becomes satisfied that such an application is endued with the power of changing the morbid properties constituting the disease in the same way as it satisfies itself that the properties of an alkali will be changed by the addition of an acid. This knowledge, then, satisfies us that the same remedies which are capable of removing *one* of those phenomena by which inflammation is characterised, may, also, remove *more* than one.

In acute inflammation, as before observed, the four elements of disease are co-existent. By the removal of one of these it is evident that the character of the malady is altered. For instance, if we reduce the temperature of the part, though the redness continue, still the disease has had its force considerably broken, and it affects the patient in a much less degree than it did at first. The pain diminishes as the preternatural heat continues to be abstracted, and what remains is only a *part* of the original affection—namely subacute or chronic inflammation, as it is termed. If, again, we empty the vessels of their contents by numerous scarifications, thereby relieving them of the preternatural quantity of blood within them, all the four elements constituting inflammation are reduced: the disease, as a whole, becomes much less severe—the *redness* is less, the *swelling* is less, the *heat* is less, and the *pain* is less.

In inflammation of an acute character; indeed, in inflammation of all degrees, the principal indication, after the removal of the morbific agent, is to restore the calibre of the vessels of the inflamed part to its natural standard. This indication is usually fulfilled by one or more of the following means: 1st, local bleeding; 2d, evaporating lotions; 3d, poultices; 4th, fomentations; 5th, liniments; 6th, escharotics; 7th, pressure. Specific applications to cutaneous affections are not here included.

Local bleeding. It is evident that local abstraction of blood,

whether by leeches, by scarifications, or by incisions, can only afford relief in a mechanical way, by enabling the weakened vessels to unload themselves. Although each capillary tube is not divided, yet, by the abundant anastomosis which exists between these vessels, every tube in the inflamed part may be relieved by free scarification. Of all local remedies, bleeding is, doubtless, the most efficacious; but it must be considered that by the removal of one disease it creates another injury, which experience proves to be occasionally troublesome, if not dangerous.

In the most severe cases of inflammation, that is, in cases where the vital contractility of the vessels has been materially reduced by the amount of morbid derangement, the motion of the blood becomes so diminished as almost to cease altogether. Indeed, it occasionally does cease, and the consequence is gangrene of the part affected. In cases of this description, it is next to impossible for the vessels to resume their contractile powers without being first relieved of the weight pressing upon their internal surfaces, and local abstraction of blood is, perhaps the most efficient mode hitherto employed of affording them that relief. Having been eased of the internal pressure, an opportunity is afforded them to recover their tone, by virtue of their innate powers as vital parts, at the same time that the mischief arising from the preponderance of deposition over absorption is in some degree suspended.

Evaporating lotions. We have already remarked, that agents which are capable of removing one of the phenomena of inflammation may also reduce or remove one or more of the others. Increased heat, or augmentation of temperature, not only forms one of the striking phenomena of the disease in its acute character, but it must also act as a cause in keeping up the derangement. It is unnecessary here to repeat any remarks which may have been already made respecting the physical cause of the increased temperature, but as it is an essential ingredient in the constitution of the malady, its reduction would be an object of much importance did it merely exist as a part of the disease; but as the natural action of caloric upon bodies is to expand them, or to induce their particles to separate to a greater distance from one another, and as the condition of the capillaries in inflammation is already that of preternatural expansion, it must follow that any quantity of heat added to them, beyond their natural measure, will tend to increase their dilatation still more. This being the case, it is doubly desirable to reduce the preternatural temperature of the inflamed part, so as to bring it as low, at least, as the natural standard, and experience has taught us that the only way of lessening the temperature of a body is to apply another body to it colder than itself, or a body which, by changing its capacity for heat, creates a degree of cold around that whose temperature we wish to reduce.

Heat and cold are merely relative terms. Whether there exist two agents capable of neutralising each other by any physical properties, or whether cold be merely the absence of heat, is a question

not worth discussing in this place, because it is sufficient to know the effects on the living body of the different degrees of temperature measured according to the common method. Appreciated in this sense the two terms are merely relative; but observation proves that the effects of the caloric agent are very different on living parts according to its degree. If the temperature of a part be below the natural standard of the heat of the blood, that part can hardly be said to be in a state of inflammation, according to the definition of the term, for preternatural heat is as essential an ingredient of the disease as pain or redness.

As the vital functions of a part become deranged if its temperature be raised preternaturally high, so will they also be impeded if the temperature be reduced below a certain degree. We find morbid affections amounting even to sloughing and gangrene, not only without any elevation of temperature, but even as a consequence of too great a reduction of heat. The toes often become "chilled," and, as a consequence, they slough, from exposure to low temperature. In these instances, we find some of the elements of inflammation without the others; we find redness and swelling, but the increased heat is wanting; and the pain in many cases is so slight as not to be complained of, even when the part is on the verge of gangrene. In cases of this description, the contractility of the capillaries is so reduced, and their calibres, consequently, are so enlarged, that the motion of the blood within them ceases : the fluid coagulates, and gangrene or sloughing is the only remedy which nature can apply for the preservation of the rest of the limb.

Although the general principle upon which lotions are employed for the cure of inflammation, is that of reducing the preternatural temperature of the inflamed seat, still if medicated they may also act specifically on the vessels and nerves of the part, by actual contact, or by imbibition or absorption. The animal body is subject to physical laws, like all other bodies, and its structure is liable to be affected by the external agents which surround it. Heat, light, moisture, and all other physical agents, continually influence its condition by being admitted by imbibition through the porosity of its structure ; and, according to the same laws, substances artificially applied to its surface will exert their properties upon it, whether these properties have a curative or a deleterious relation with it.

Poultices. Being subject to physical laws, like matter in general, the animal body may be affected in different degrees by the same agent under different circumstances. If a piece of iron, whose temperature is a few degrees above that of the blood, be applied to the skin, the effect is very unpleasant, and the functions of the tissues would be deranged if the temperature were still a little higher ; whereas water, or especially atmospheric air, whose temperature is considerably greater will be borne with perfect impunity, and even without much inconvenience. Again, if the air be dry, the body will

bear a great degree of cold without inconvenience, whereas in a moist atmosphere a degree of cold not near so great becomes very unpleasant. It is upon this principle, we conceive, that poultices are more advantageous in some cases than evaporating lotions, and less so in others. When the preternatural heat is very great, its reduction is more readily accomplished by lotions, which, by rising into vapour, abstract the caloric more readily and quickly; whereas if the temperature be only a little above the natural standard, the rapid abstraction caused by the lotion reduces it so low as to occasion pain, or at least an unpleasant sensation, in the part affected. A moist poultice, although presenting an evaporating surface, transmits the heat but slowly from the inflamed part, and continually retains a part of it in its substance, thereby contributing to render its temperature more equable. In this respect it is much superior to an evaporating lotion, and considerably more efficacious in many cases of inflammation.

A medicated poultice, like a medicated lotion, may exert a direct influence on the diseased vessels by imbibition or absorption.

Fomentations. Unless medicated, fomentations cannot be supposed to act otherwise than by softening the cuticle and promoting a degree of perspiration from the part to which they are applied. Experience proves that the effect of dry heat upon the skin is very different from that produced by a combination of heat and moisture. The sensation occasioned by the application of a hot fomentation, even to a part already of a higher temperature than natural, is generally agreeable to the patient.

Heat combined with moisture tends to promote perspiration from the surface to which it is applied, thereby in some measure to relieve the over distended vessels of a part of their fluid contents. The cuticle over the inflamed part is generally dry, and its pores are filled up, probably, by a portion of the lymph thrown out by the vessels underneath, and which has become coagulated. Whether this be the cause or not, it is certain that the perspiratory exsudation does not go on so fast as in the healthy state of the part, and that warm fomentations possess the property of relieving the density of the cuticle, so as to enable it to allow the exsudable serum to pass more readily through.

Embrocations and liniments. It is seldom that remedies of a "stimulating" nature are applied to a surface undergoing acute inflammation. Indeed according to the composition of this species of application, the remedy, if employed, might be more unendurable than the disease itself. But, that spirituous fluids may not only be safely, but beneficially employed in local inflammation, even of the most acute kind, is proved by the effect of oil of turpentine in cases of burn and scald. It is the addition of ammonia, camphor, essential oils, and other ingredients, to the spirit, that renders embrocations generally unfit applications for inflammation of the acute form. In the employment of remedies of this description—in fact, of all remedies—it should never be forgotten that the same ingredients

may be congenial or uncongenial to the feelings, according to the strength or intensity in which they are applied. Pure alcohol, or a concentrated solution of ammonia, would, probably, raise the cuticle and produce a blister, whereas, diluted, they would only gently increase the exsudation from the extremities of the vessels. Embrocations are most commonly used with the view of removing the *effects* of inflammation, namely, the thickening and induration dependent upon the consolidation of serous lymph in the interstices of the structure; and, for this purpose, both they and *liniments* are medicated according to the discretion or the fancy of the practitioner. As a proof that such applications have their effects, not only on the local seat of disease, but also on the system at large, we find that mercury thus introduced will very readily affect the gums, and cause salivation.

Escharotics. The employment of escharotics, or rather of the nitrate of silver, in inflammation has been in vogue for some years, and was first introduced by Mr. Higginbotham, of Nottingham. The immediate effect of the application of the caustic to the inflamed surface is the conversion of the cuticle into a dry, black scale or crust, which peels off in a few days, leaving a new, delicate layer of cuticle exposed underneath. That the remedy exerts a powerful effect on the arterial extremities of the part, is proved by its causing an entire separation between the cuticle and the skin whose vessels secrete it. Various conjectures respecting the mode of action of this application have been offered, but none of them appear very satisfactory. Mr. Higginbotham thought that its efficacy might depend upon the exclusion of the air from the inflamed surface, owing to the conversion of the cuticle into an impenetrable covering. But we find that internal parts, such as the peritoneum, &c. to which the atmospheric air has no access, are still liable to inflammation; and, moreover, it can hardly be supposed that an agent which is necessary to the surface of the skin in its healthy state can be injurious to it in a state of inflammation.

As a ready way of getting out of the difficulty, the lunar caustic, like a hundred other applications, has been said to act as a "stimulus" to the part, and to excite the vessels to a "healthy action." This, in plain terms, is saying nothing more than that it does good —that the inflammation gives way where it has been applied. The term "stimulus" is employed so vaguely that no correct idea can be formed of what is meant by it. We are told that cold stimulates the vessels to contract; that heat stimulates the part to inflame, that ammonia stimulates the capillaries to enlarge and the skin to blister; that lead stimulates them to contract, and the skin to corrugate. Again, with respect to "healthy action:" we only know that the "action" of the vessels is healthy from the part supplied by them being healthy; which amounts to nothing more than saying that the part is in its natural state.

Simple Pressure.—That compression is capable of producing a decided effect on the living structure, is proved by the fact that a

bandage long worn round a limb will cause that limb to become materially smaller than natural. It may be asked how does pressure act ? In reply it must be admitted that it either diminishes secretion or increases absorption, or both ; for we know of no other way in which the reduction of size can be accomplished. We have already stated it as probable, that the same agent which causes the capillary tubes to enlarge so as to exude more concretible matter than they do in their normal state, might also produce an enlargement of the absorbent vessels, thereby rendering their function less active than natural. If such a view be admitted, the reverse may also be true, viz. an agent which causes a diminution of the diameter of the secreting capillaries, or secerning tubes, and reduces their calibre below its normal standard, will also act in a similar manner upon the absorbent vessels, and occasion their function to become more active than natural. Now, compression will accomplish both these purposes. It acts equally on all the vessels, both secreting and absorbent, and the effect is, that the double object is obtained, namely, a diminution of the function of the one class, and an augmentation of that of the other.

In inflammation possessing no specific character, after the exciting cause has ceased to act, and when only a relaxation of the capillaries, from diminished contractility, remains, a gentle and equable pressure on the inflamed part is one of the most efficacious remedies in common practice. Its effect, evidently, is mechanical. It can in no other way act than by occasioning a diminution of the calibre of the vessels, thereby preventing their depositing a preponderance of molecules over those taken up by virtue of the function of absorption. The consequence is, that by relieving the coats of the blood-vessels of a part of the weight pressing upon them internally, those vessels are more free to resume their contractile power, and the equilibrium between secretion and absorption is re-established.

An effect similar to that of pressure may be produced by obstructing, by ligature or otherwise, a principal artery supplying a part. The structure loses a portion of its sensibility and of its temperature, and the part becomes pale and wasted. These are conditions the very reverse of those by which inflammation is characterised, and such being the case, the inference, à priori, would be that a remedy calculated to bring the inflamed part into such a state must tend to remove the inflammatory process going on in it.

Upon the therapeutic properties of those remedies which are generally termed " specifics," it is not necessary to dilate here, as they apply more particularly to a few diseases which propagate their kind by contact, or by the transfer of a portion of the morbific matter from one person to another. The only idea we can form of a specific disease is, that the morbific agent, which first gave rise to the malady, continues in operation until subdued or neutralised by some other agent capable, by affinity, of converting it into another form, thereby altering its properties.

ON THE THERAPEUTIC PROPERTIES OF IODINE.

Iodine, as a remedial agent, has been in the hands of the profession for many years, but the object of the present work is to show that its application may be extended with much benefit to diseases and local injuries in which it has hitherto been very limitedly, if at all, employed. The various local affections in which we have used it during the last eleven years, both in hospital and private practice, induce us to set it forth as by far the most efficient topical application in our possession. The mode in which we have generally employed it, has been that recommended by Mr. Buchanan, namely in the form of tincture ; in which form, *certainly*, it possesses remedial properties which it does not exhibit in any other. Why this should be the case we do not profess to know, but long experience proves such to be the fact.

In urging a remedy on the attention of the profession, it is necessary at the same time, to caution the members of that profession against the indiscriminate and indiscreet use of it. Many valuable medicines have fallen into disrepute, and have been altogether discarded from the list, owing to their having been mismanaged or abused. Iodine, though not a *new* remedy, has by no means yet had its effects on the human system fully tested. Properties have been attributed to it of which it is quite devoid, while, on the other hand, it is endued with many therapeutic virtues which it has not been generally known to possess.

It is not the intention here to treat of iodine as an internal remedy, but we may be permitted, in passing, to observe that we have never witnessed it to produce the effects attributed to it on the testes and mammæ, namely, causing the absorption of these glands. We have administered it internally very extensively, and in many cases, for several months together, yet *not in one instance* did it reduce the size of the glands already mentioned. We may also be allowed to state that we have been much disappointed in it as an internal remedy, more especially in scrofulous affections, for which it has been cried up almost as a specific. Its curative effects in bronchocele are so well established as to render it unnecessary to do more than mention the fact ; but, with the exception of that affection, its medicinal virtues, according to our experience, are rather limited, when internally administered. It is however proper to mention, that we have found it one of the most useful remedies in cases of long continued dyspepsia, and in some other affections of the mucous membrane of the digestive canal. It is probable that it acts in these cases by immediate contact, and not through the medium of the circulation : be that as it may, its curative effects are very striking in chronic affections of the lining membrane of the digestive tube.

But the principal object of this essay is to point out the benefits of iodine as an external application ; and, in doing so, nothing shall

be stated which repeated observations have not proved to be correct.
We are well aware that when a single remedy is set forward as a
cure for a great number of diseases, it is apt to be looked upon with
great distrust by the profession, and that those who happen to recom-
mend it are liable to be charged with something like empiricism.
As well might those who prescribed mercury in a variety of diseases,
or those who prescribe sulphate of magnesia, or carbonate of soda,
or opium, in a variety of affections, be charged with empiricism.
In truth, what do our common external applications amount to?
Chiefly to lotions and poultices; and practitioners generally do not
much vary the characters of their lotions and poultices in different
local affections.   There are few external diseases, or local injuries,
for which both of these are not employed in their turn.   If a simple
evaporating lotion be applicable to cases of phlegmon, of erysipelas,
enlargement of the joints, scrofulous swellings of the glands, lace-
rated, contused, and punctured wounds, and a variety of other
inflammatory affections, both of the skin itself and of the internal
parts situated near it, why should not another remedy apply equally
to a number of similar maladies?   The properties of remedial agents
can only be judged of from the effects they produce.   No one could
tell *à priori* that sulphate of magnesia would purge, and that
carbonate of lime would constipate the bowels.   In like manner,
the medicinal virtues of opium, hyoscyamus, prussic acid, mercury,
and all other remedies, have been discovered by observation of their
effects respectively on the animal system, for they exhibit no
external qualities which could lead to a fore-knowledge of their
relations with the living body.

Now, extensive observation, and the experience of several years,
have proved iodine to be a most efficacious remedy in a great
variety of local affections—*much more* efficacious than any of the
remedies noticed in the last section.   It is very easy of application,
mild in its effects on the nerves of the part with which it comes in
contact, and capable of being modified in the degree of its strength,
so as to suit it to the intensity of the disease and natural quality of
the skin of the patient.

Both at the infirmary and in private practice we are in the habit
of using the iodine in two forms, but by far more frequently in that
of tincture in alcohol.   The tincture is made by dissolving forty
grains of iodine in an ounce of rectified spirit; and its strength
is afterwards reduced, when necessary, by the addition of more
spirit.   The other form is an iodureted solution, which is made by
dissolving thirty-two grains of iodide of potassium (hydriodate of
potass (in an ounce of distilled water, and by adding to the solution
eight grains of iodine.   With this iodureted solution a lotion is
made by the addition of distilled or of common water, varying in
strength according to circumstances, from one eighth to one fourth
of the former.

The strength of the remedy must be determined by the quality of
the skin, in the first place.   When the skin is thin and delicate in

texture, the tincture should be reduced to half its strength, otherwise the cuticle may be raised in blisters, which should always be avoided if possible. When, on the other hand, the cuticle is thick, and of a coarser texture, the tincture may be applied undiluted. In the second place the strength must be regulated by the nature and intensity of the disease. If, for instance, we have an acute inflammation of any part, and if, most particularly, it shows a disposition to slough, the remedy must be used in its full strength. In all cases of sloughing ulcers ; in all cases of irritable ulcers; in all cases of lacerated, contused, or punctured wounds, the strength of the tincture should *not* be reduced—it should be applied undiluted in the first instance ; but when the slough has separated, or the irritability has ceased, and when the remaining object is merely to promote the growth of granulations, then the strength ought to be reduced about one half. In induration of the glands, in chronic affections of the joints ; in inflamed breast ; in fact, in all affections whose seat is *under* the substance of the skin, the tincture should be employed in its full strength, unless the skin covering the seat of disease be very delicate or irritable—we mean *naturally* irritable, for the remedy itself would soon deprive it of any *morbid* irritability.

Suppose we are called to a case of severe inflammation of the leg, in a stout, robust person ; the limb is intensely red, hot, swollen, and glossy, all the way from the toes to above the knee ; it is double the size of the corresponding one ; and so painful as to disturb the general health—as to cause quickness of the pulse, white tongue, thirst, &c. We immediately *paint* the whole limb with the tincture of its full strength, extending its application from the toes to several inches above the upper margin of the inflammation : the remedy is applied with a camel's hair brush. This is all the local application requisite for the present. The limb is directed to be kept in an horizontal posture, and either to be very lightly covered over with a sheet—which must not come in contact with the skin—or else to be left exposed, according to the temperature of the apartment. In less than twenty-four hours—in less than twelve hours—the swelling will be found to have diminished. At the end of twenty-four hours the skin will be seen much corrugated, showing its contents to have become less in bulk, and the circumference of the limb will measure some inches less than the day before. The diminution will be found to have taken place more particularly towards the upper part of the swelling. We now repeat the application of the same strength. In another twenty-four hours the reduction of the swelling will have gone on rapidly, and only a remnant of the disease will be found to exist. The strength of the tincture must be now reduced to one half, and its application continued daily, or less often, according to circumstances, until the limb is well. After the second or third applications of the tincture, we sometimes brush the limb over with spirit of wine alone, so as merely to dissolve the iodine which remains on the surface of the skin.

The above is the usual effect of the remedy in cases of pure

phlegmonous inflammation, but it varies, of course, in different constitutions. The variations, however will be found in the *degree* only of its *curative* effects in different cases; it may be employed in *every* case, with the full confidence that *benefit*, and not *harm*, will be the result. The only inconvenience we have ever witnessed to arise from its use has been that of causing, now and then, a slight watery eruption on the surface of the skin, and a degree of itching in the part, when employed too strong, or when persevered in too long. These eruptions have invariably given way in a few days to a simple evaporating lotion of spirit and water.

The application of the tincture is almost always followed by a desquamation of the cuticle, leaving the part covered by a new, clean, healthy layer of cuticle. This takes place when it has been applied to a healthy part. On the healthy skin it generally causes a sensation of heat, and some degree of smarting after a few minutes; but frequently no smarting or pain is felt—nothing but a slight and agreeable warmth. When applied to a part undergoing the process of inflammation, the pain which forms one of the essential characters of the disease, soon becomes deadened, and is succeeded by a sensation of warmth, which, in a few hours, ceases also and leaves the patient free from any sense of pain or heat in the seat of disorder. If applied to the surface of a sloughing ulcer, or to a part on the verge of gangrene, or to a foul irritable ulcer, it is seldom felt by the patient. On a healthy ulcer it produces, generally, a very sharp, smarting pain for a minute or two, but the pain almost immediately ceases and leaves the part in a comfortable state. The same sensation is produced by it when applied to the surface of a recent lacerated wound, or to any healthy raw surface.

If any itching, or a slight blush of the skin, should follow the repeated applications of the remedy, especially on the lower extremities, it should be discontinued, otherwise the cuticle will rise into small watery pimples, and will tease the patient for a few days; but this effect is produced by it on the *healthy* skin only—when applied, for instance, to the skin covering a diseased joint, or when any induration or swelling is situated under the skin—for we have never found it to blister the cuticle and to cause exsudation of lymph from the surface of an *inflamed* skin.

Neither the iodureted solution, nor the tincture of iodine, as directed to be prepared by the London Pharmacopœia, is applicable to cases of inflamed or of ulcerated skin, for they both contain hydriodate of potass. In either of these forms the iodine is far preferable for *internal* use, to being dissolved alone in alcohol; for in the latter form it nearly all precipitates when water is added to it, whereas the hydriodate in combination with it renders it perfectly soluble in water or watery infusions. As an external application, however, the hydriodate renders it acrid, and gives it a tendency to inflame the skin and to cause a considerable degree of smarting when brought into contact with any ulcer or ulcerated surfaces. The iodureted hydriodate lotion is only applicable to

affections whose seat is under the skin, such as diseases of the joints, scrofulous tumours, glandular indurations, &c.; but even in most of such cases the tincture is far preferable, when the patient is so situated as to enable the practitioner himself to apply it as often as necessary. We state this proviso, because we never trust the employment of the tincture to the patient.

The iodureted hydriodate solution, like the tincture, produces a desquamation of the cuticle if used strong, but this only becomes observable some time after the lotion has been left off, and the skin has become dry. As stated before, we seldom use this form of the remedy, except in cases where it is not convenient to see the patients so often as required for the application of the tincture, because the latter, when properly regulated in its employment, proves by far the more efficacious of the two in most instances; but if indiscreetly used, on the other hand, it is more likely to cause an unpleasant sensation in the skin of the part to which it has been applied. The solution forms a very ready mode for an iodine gargle, in cases of ulcerated sore throat. Diluted with from seven to ten parts of water, with the addition of honey, it forms one of the best kinds of applications of that description. But even in affections of the mouth and throat the tincture is preferable—it is less nauseous to the patient, and quicker and more efficacious in its curative effects.

We have already stated, that a knowledge of the effects of different substances on the living body can only be acquired by observation. There exists nothing in the external qualities of sulphate of magnesia, of jalap, of colocynth, of scammony, of elaterium, of Glauber's salts—which are all so dissimilar in their outward form—to enable us to foretell them capable of quickening the peristaltic action of the intestinal tube, and of increasing the secretion on the surface of its mucous lining; nor could any one judge à priori that ipecacuanha, sulphate of zinc, or tartarised antimony, would cause the stomach to eject its contents, for these articles, also, possess few outward qualities in common. Their medical properties become manifested only in relation with the living parts. When so tested, their effects prove to be pretty much the same on by far the majority of mankind. In 99 cases out of 100 of the whole community—we might, perhaps, say in 999 out of every 1000—the effects of the articles enumerated above would be the same.

If substances administered internally are so constant in their effects on certain inward parts, there is no reason why outward applications should not be also constant in their effects on the external parts. It does not follow that either will cure the disease for which it is administered, or applied; but as Epsom salts exert an effect generally alike on the mucous membrane of the intestines, we can discover no reason why the analogy should not apply to the *skin*, which is also a continuous tissue, like the mucous. That the disease is not cured, or modified, in all cases, is not owing to any

uncertainty in the action of the remedy, but owing to that not being *the* remedy which bears a relation to the special tissue constituting the immediate seat of the malady. Experience proves the analogy: it proves that nitrate of silver will convert the skin into a black colour, and will destroy its texture if applied sufficiently intense: that pure potass will dissolve all the living tissues: that cantharides will raise the cuticle: that mercury, and other substances, will penetrate the skin and enter the general system, &c. In fact, all substances capable of making any impression on the surface of the skin, act alike on the great majority of mankind: the difference is in degree only.

Now, iodine, in the form of tincture in rectified spirit of wine, is capable of producing—does produce—certain effects on the skin, and on the living parts generally, when applied to them. The nature of that effect can only be known from observation. Experience proves the effect to be of such a nature as to remove inflammation; as to enable the living parts readily to throw off any sloughs which may be attached to their surface; as to make granulations spring up rapidly, so as to fill up the loss caused by the sloughing; as to promote the absorption, or cause the removal of interstitial deposites situated in the cellular membrane under the skin; and as to accomplish various other changes in the condition of morbid parts, which will be more particularly specified hereafter. That tincture of iodine is not as *certain* of doing these things as sulphate of magnesia is of relaxing the bowels, is owing to the one exerting its effects on a *healthy* surface, and to the other acting on a *morbid* part. The effect of iodine on the healthy skin is as determinate as that of Epsom salts on the mucous lining of the intestinal tube; namely, it will cause a certain degree of warmth to the sensation, followed by a slight smarting, and, lastly, by a desquamation of the cuticle. When the structure of parts has become changed, as a *consequence* of morbid action, it is doubtful whether there be in nature a remedy capable of restoring them to their normal state; but as the first effects of disease often act as a cause for further disease—in other words, as vascular deposites, or structural changes, have a tendency to keep up irritation in the parts where they are situated, thereby tending to promote further morbid changes—it is highly desirable to possess the means of modifying the properties of the vessels of the altered structure, in such a way as to prevent their depositing more morbid matter, and, if possible, to induce them to remove some of that already deposited. Experience proves that we possess such means in the remedy whose recommendation is the object of this essay.

Admitting the facts above stated, it is, perhaps, sufficient to know that such effects follow the application of the remedy in the majority of instances, without attempting to account for its *modus operandi*. If we offer an opinion respecting the rationale of its operation, we, at the same time, respectfully insist that the reader do not take the failure to give a satisfactory *reason* for its mode of acting,

as a justification for rejecting the practical *facts* respecting its effects.

Disease may be considered in two stages: first, the part still suffering under the influence of the morbific cause which first produced the local derangement; second, the part merely existing in a state of derangement, as a *consequence* of the previous action of a morbific agent. The first condition may be illustrated by the morbid process of a chancre; by the local operation of the variolous, or of the vaccine virus; by the progressive march of lupus, &c. In these cases, and various others, the cause or morbific agent appears to be of a specific nature, and to increase in magnitude and energy as the disease advances: in fact, the agent of disease appears to live and feed upon the living parts in which it resides. In other cases, the first action of the morbific cause produces a vital derangement of the part with which it comes in contact; and the agent then either becomes absorbed or swallowed up in the effect, by entering into new affinities, or else is eliminated from the body among the secretions. We will first consider disease in its second state.

When the seat of disease has relieved itself from the operation of the original cause of derangement, it still generally suffers from the effects of that operation. The capillaries are in a relaxed state; they contain more than their due proportion of blood; there is a tendency in the part to preponderate in secretion over absorption; and its nervous functions, dependent upon the integrity of the functions of the capillary extremities, do not resume their normal condition. Moreover, there may have taken place a deposite of lymph in the interstices of the structure, so as to constitute a new cause of vital derangement.

In such a state of things, it appears reasonable that the first step towards restoring the part to its natural state, should be to induce the capillary vessels to resume their contractile power, so as to enable them to free themselves from their disproportionate burthen. That the application of the tincture of iodine is endued with the virtue of accomplishing that object, is proved by the fact that the swelling of an inflamed limb very rapidly subsides as a consequence of its application. We say as a "consequence" of its application, because when a similar occurrence invariably takes place under similar circumstances, we have a right to assume that there exists a necessary connection between them.

As to the *manner* in which the remedy acts on the morbidly dilated vessels, we are just as ignorant—but not more so—as we are of the nature of the action of muriatic acid on a piece of marble: all we know is, that one agent possesses the innate virtue of modifying the properties of the other in either case; and experience alone can teach us the result, or acquaint us with the nature of the product of the change.

It is a fact, within the knowledge of every practitioner, that arteries exposed to atmospheric air will contract, and diminish—nay,

close—their canals. When the stump of a recently amputated
thigh is exposed, thousands of vessels bleed at first. At the expi-
ration of a minute not one in a hundred of them will allow any
blood to escape. At the expiration of three or four minutes more,
perhaps the whole number will have ceased bleeding, if the prin-
cipal branches shall have been secured. Nothing more will appear
than the oozing of colourless lymph from the whole surface. Now,
this fact must satisfy every one, first, that vessels of considerable
size *are capable* of obliterating their canals, by means of some con-
tractile power inherent in themselves; second, that the action of
this power may be encouraged or excited by the application of
physical agents. In the instance specified, the agent which influ-
ences their contractile power is the atmosphere. If atmospheric
air is capable of producing such an effect upon the vessels, there is
no reason why other agents should not be able to produce a similar
effect. In truth, we find, as already stated, that iodine, in the form
of tincture, possesses the property of doing so ; and the effect of
its application to an inflamed and swollen part is a diminution of
the redness, as well as of the swelling, in consequence of the pre-
viously over-dilated capillaries having recovered a great portion of
their contractile power.

It was hinted at in the last section, as probable, that the same
means which are calculated to cause diminution of secretion, have
also a tendency to increase the activity of the absorbent function.
The grounds of the inference were there stated. The fact is indis-
putable that certain agents do occasion the removal of interstitial
deposite, at the same time that they subdue the inflammation,
which is the cause of that deposite. In doing so, they must accom-
plish something *more* than restoring the balance between secretion
and absorption, because a mere restoration of the balance could
only serve to subdue the inflammatory condition of the part, leaving
the morbid deposite where the over-dilated capillaries threw it out.
Before the extraneous matter can be removed, after once having
been deposited, there must be a preponderance of absorption over
secretion—the excess must be transferred from the capillaries to
the absorbents, or whatever agents there be which take up the
matter.

Among the agents capable of producing the effects above men-
tioned, iodine is by far the most efficient with which we are ac-
quainted. It not only subdues the inflammatory state of the part
much quicker than any other local application, but it also reduces
the swelling, and causes the absorption of morbid deposites, much
faster than any other remedial agent. It should, however, be borne
in mind that it will not prove successful in *every* instance, any
more than other remedies.

According to the same principle that it subdues inflammation by
exciting the contractility of the capillaries, iodine causes the living
vessels to cast off the slough from the surface of foul ulcers. The
slough is nothing more or less than a portion of the animal struc-

ture which has suffered death from the intensity of the disease. In consequence of the preternatural expansion of the vessels, the blood within them entirely stagnates; and when that condition occurs in all the vessels of a part, however extensive or however limited, its death is the necessary effect. Now, although the preternatural dilatation often extends a considerable distance from the slough, still there must be a point where the dead and the living parts meet—a point where the blood is all but at a stand still, yet where it continues to move. As the stagnation of the blood, and, consequently, the death of the part, are owing to the total loss of contractility in the capillaries, it seems reasonable that a remedy capable of producing their contraction should enable them to resist the progress of the sphacelus, and to separate themselves from the dead matter. The separation takes place at the point of junction between the living and dead parts of the vessels. The living parts of the tubes having recovered some of their contractile power, they gradually diminish their calibre; the velocity of the blood in them consequently increases, which tends to add more and more to their vitality; they effuse a purulent fluid from their extremities, which serves as a medium of division between the dead slough and the living structure; and the consequence is a separation of the dead from the living part, leaving a healthy granulating surface exposed.

But, supposing the morbific agent still to exist in the seat of disease, is the remedy capable of neutralising it, and of rendering it innocuous to the living tissues? In reply, it may be said that we have no means of proving, indisputably, whether or not the original cause of the derangement be still in operation. The inflammation may be of that kind commonly called "spontaneous,"—that is, it may arise from a cause which cannot be discovered: in one instance, it will cease without any artificial aid; in another, it will run on to the destruction of the life of the part affected. In the former case, the cause ceases to operate of its own accord: even in the latter we cannot be positive that the morbific agent has continued in operation until gangrene has actually ensued; for its first impression may have been of such nature as to produce so great a derangement in the functions of the part as ultimately to lead to its death, although the original cause no longer continues to act. This point may be illustrated by the effects of mechanical violence: the seat of violence may not be destroyed at once, but its vital functions may be so disturbed as necessarily to lead to its death shortly afterwards.

Under these circumstances it is impracticable, in common inflammation, or its consequences, to determine whether the original morbific agent still continues to exert its influence on the seat of disease, because, although the malady appears to progress in its march, yet that circumstance may be owing to the extent of the original disturbance, which disturbance acts as a fresh cause in perpetuating the inflammation. The only affections, therefore, in

which we can infer the morbific cause to be still in operation, are those termed "specific."

Now, the agent, or virus —or whatever the cause may be called— of a specific disease, must be different in every species of disease. The syphilitic differs from the variolous, the variolous from the psoral, &c. As this is the case, it is not probable that any *one* remedy exists in nature capable of neutralising the cause of *every* disease. It can only be determined by experience *what* affections of a specific kind are able to be subdued by the application of a remedy. Those in which our own experience has proved the tincture of iodine to be beneficial, will be noticed under their proper heads; but we admit that our experience of its use in specific diseases has not been so extensive as to enable us to speak with positiveness with respect to its curative properties. The facts must be taken as they are : we have no wish to magnify them.

ERYSIPELAS.

In pure erysipelas, the tissue immediately affected appears to be the skin; but in most instances the malady is of a mixed nature, involving both the skin and the cellular membrane underneath. When it presents itself in its simple form, the skin looks of a bright crimson colour. The redness disappears under the pressure of the finger, but very soon returns after the pressure has been removed. There is a burning sensation in the part affected, but no sense of throbbing, as felt in phlegmonous inflammation. The peculiar burning or smarting sensation experienced in this disease, is owing, doubtless, to its being so specially allied with that tissue in which the nerves of touch spread out their extremities; and the absence of throbbing may be easily accounted for, because the vessels engaged in the inflammation are so exceedingly small and minute, that, even at the utmost extent of their expansion, they are not large enough to impart a throbbing sensation either to the finger when applied to the inflamed part, or to the feel of the patient himself. But, owing to the countless number engaged, and to their being situated so near the surface, the skin presents a colour of the brightest crimson.

This variety of the disease generally spreads to a considerable extent over the skin, and, when severe, it gives rise to a separation of the cuticle, in the form of bullæ or blisters, which contain a serous fluid, generally of a yellowish colour, but sometimes almost transparent. When these blisters give way, and the fluid escapes, incrustations are formed on the surface, under which ulcerations not unfrequently take place.

There is generally a considerable degree of constitutional derangement accompanying cutaneous erysipelas. The tongue is coated; the pulse is small and quick; there are thirst, uneasy sensation about the præcordia, and a universal feeling of languor and debility. The severity of these symptoms is often disproportionate

to the apparent extent and severity of the local inflammation; which, probably, is owing to the peculiarity of the tissue affected, namely, its being that upon which nerves of sensation are extensively distributed.

The head and face are the parts most subject to erysipelas when it arises from constitutional causes: indeed, local injuries of these situations are much more apt to be followed by the disease than those of any other parts of the body. The removal of small tumours about the head, or even the application of a few leeches to the temples, is not unfrequently followed by fatal erysipelas; whereas the same kind of injury inflicted on any other part would not give rise to the malady.

In all the instances in which we have had an opportunity of examining the seat of disease after death occasioned by erysipelas about the head, the skin was found very much thickened, and its texture to have become very soft; and the cellular membrane between it and the bone was converted into a substance exactly like yellow jelly. The dura mater, also, in every case, partook of the disease.

But erysipelas seldom confines itself altogether to its simple form, in any locality. The cellular membrane in contact with the skin, and, frequently, that portion of it also which is situated more deeply among the muscle, partakes of the disease. When this occurs, extensive sloughing generally takes place; openings are produced in the integuments, by partial sphacelus, through which the dead cellular membrane protrudes in masses, and is ultimately discharged, if the patient survive, leaving hollow spaces to a great extent between the integuments and the flesh. This variety of the malady is commonly called "phlegmonous erysipelas."

The foregoing description forms a sufficient illustration of the symptoms and morbid appearances of erysipelas to answer the purpose of this work. With respect to its *cause*, it is a mere matter of opinion or of speculation: our notion, with regard to that subject, may be gathered from the previous sections.

With reference, also, to the constitutional treatment of erysipelas, and of the other diseases of which we shall speak in this essay, it is proper to state at once, that little will be said here; because the object of the work is *not to present a full treatise* on these several affections, but to illustrate the *local effects* of a certain remedy in them. It is not pretended that the local remedy will supersede the necessity for general treatment, when constitutional symptoms demand such treatment. But, as the constitutional disturbance frequently depends upon, at any rate is aggravated by, the local disease, it will often be found that by reducing the latter, the former will also diminish, and, perhaps, altogether disappear, without the aid of any general means. This fact we have witnessed in very many instances. But the safer plan is not to neglect general treatment in affections insidious in their nature, and whose course is generally short, either towards restored health, or towards death.

As a general statement, then, respecting the constitutional treat-
ment of inflammation, whether of the erysipelatous or of the phleg-
monous kind, *except in very plethoric cases*, experience has taught
us to be *cautious* in the abstraction of blood from the general
system. By this expression, it is not meant to intimate that *no* blood
should be drawn by venesection in any case: but even where its
abstraction is fully authorised, it should be accomplished with
moderation, and not in the reckless manner too often practised.

Having *well* cleansed out the alimentary canal, *without loss of
time*, with eight or ten grains of calomel, followed by saline purga-
tives, our practice has been to administer calomel and opium, in
doses according to circumstances, and repeated at intervals of from
three to six hours, until the system has been brought *fairly*, but
slightly,, under the influence of the mercury; which is proved by
a slight redness along the edges of the gums, or by the patient's
feeling a slight looseness of the teeth. The remedy should be then
immediately stopped.

So much for general treatment, which will apply to every variety
of acute inflammation, differing, of course, in modification, according
to various circumstances connected with each case.

But the object of the present essay, as stated before, is mainly to
bring to the notice of the profession a local remedy whose curative
properties, compared with those of other topical applications, are
very little known at present.

The topical remedies commonly used in erysipelas are local
bleeding by leeches; simple evaporationg lotions, or lotions medi-
cated with lead, zinc, acetate of ammonia, opium, camphor, or any
other ingredients, according to the views or fancies of the prac-
titioner; fomentations, generally of chamomile and poppy heads;
poultices, simple or medicated; incisions through the seat of inflam-
mation as recommended by Mr. Lawrence; scarifications as recom-
mended by Dr. Dobson; the application of lunar caustic, as recom-
mended by Mr. Higginbotham. Of the *modus operandi* of all these
plans, we have already spoken, and the degree of reliance to be
placed on each or all of them in erysipelas, is so well known as to
render it unnecessary to treat of them specially here. But it will
be found, upon trial, that the tincture of iodine is a topical remedy
far more efficacious than any of them, or of all of them put
together.

An elderly gentleman, who, in former years, had been a very active
man, began to decline in general health about 1828, or the beginning
of 1829. His bowels became irregular: his complexion appeared
"bilious;" his mental faculties, which were naturally very strong,
began to show a decline; and, in a word, the general functions of
the system became all more or less disordered. He was repeatedly
cupped and leeched on the nape of the neck and temples, and the
parts generally showed a disposition to inflame, more especially
when leeches had been applied. In the summer of 1830, after the
application of several leeches to the forehead and temples, a severe

attack of erysipelas came on, which rapidly spread over the head and face, accompanied with a good deal of constitutional disturbance, such as quick pulse, furred tongue, and general uneasiness. The head was bald, having only a thin curtain of hair behind. *The tincture of iodine, reduced to half its strength, was applied by a camel's hair brush all over the head, temples, and face ;* which, as may be supposed, gave him an odd appearance, from the brown or bronze colour it imparted to the skin. Next day the disease had all but disappeared. The local inflammation had very nearly ceased, and the symptoms of constitutional derangement had much abated. The tincture, however, was applied once more, but still reduced in strength. No further trouble was found with the case.

The above was the first case of genuine erysipelas of the scalp in which the tincture of iodine was employed, and the effect was so striking as to encourage a repetition of the trial. From the unhealthy state of the patient, and from the rapidity with which the inflammation extended over the head, it was impossible not to entertain great apprehension as to the result. Under all the circumstances, the effect of the remedy proved most gratifying, both to the patient's friends and to the medical attendant.

In the autumn of the same year, a young man aged about 19 or 20, of a sickly bilious look, and subject to headach, especially after his meals, was seized with "spontaneous" erysipelas of the face. The inflammation commenced in one of his ears, and from thence spread over the temple, and ultimately over the whole scalp. When he applied for assistance, there were a few vesications about the ear and cheek : the head and face were considerably swollen, and very tender to the touch : and the whole scalp felt doughy and soft, and retained deep pits after being pressed with the finger. The general health was suffering much.—The hair was ordered to be cut off close to the skin, and the tincture of iodine, in its full strength, was applied all over the inflamed surface, which embraced the whole head, down to the neck. By the next day the swelling was very much abated, and the general symptoms were less severe. The tincture was again applied in its full strength. After the second application, the tincture, was reduced daily in strength, and used for two or three days longer. It is very probable that one or two applications would have sufficed to subdue the inflammation, but it was deemed prudent to repeat them daily for four or five days. The remedy was followed by a desquamation of the cuticle of the whole head ; but the skin became quite clean and fresh in a few days. In this case, as well as in numerous others, the inflammation began to give way before the mercury, administered internally, could have affected the general system. Indeed, it was found unnecessary to press it so far as to affect the mouth, when the disease was fast disappearing without.

The remedy has since been frequently employed in cases of the above description—that is, erysipelas, of the head and face—both at the infirmary and in private practice, *with uniform good effect.* It

is unnecessary to recite more cases of this variety. Indeed, the few cases introduced in this work are merely intended to illustrate the mode of application of the remedy, and not to swell out or multiply its pages. If that were the intention, we could recite some scores. In consonance with our object, we shall state the two following cases; the first of which will come under the term " phlegmonous erysipelas," and the second will answer any term applicable to an anomalous swelling of a limb.

In February, 1830, a tradesman's wife, aged about 50 years, stout, but of an unhealthy appearance, had one of her legs very much inflamed all the way from the toes up to above the knee; it was swollen to at least double the size of the opposite limb. The inflammation arose from a slight scratch on the shin, and was of some days' standing, during which time cold lotions and fomentations had been applied to the part. The limb now presented a glossy, shining redness, from above the knee down to the toes; its size was as just stated; it pitted slightly on being hard pressed with the finger; there were several vesicles, containing transparent serum, on the back of the foot and lower part of the leg; the pain was excessively burning and acute, and the constitutional disturbance was very great. The tincture of iodine, of full strength, was applied all over the inflamed surface—that is, from the toes up to the middle of the thigh;—and the limb was directed to be kept in a horizontal position, and left exposed to the air. Next day the pain was nearly gone: the limb was considerably reduced in size; and the skin, especially about the knee and upper part of the leg, was shriveled into folds in consequence of the subsidence of the swelling. The fluid in the smaller vesicles had been absorbed, and the others were much smaller than the day before. No new vesicles had made their appearance. However, there was still considerable swelling of the lower part of the leg and foot, and the inflamed part still pitted on pressure, though not so much as on the previous day. The tincture was repeated, in its full strength. After the second application it was reduced in strength, and on some days rectified spirit alone was applied, merely with the view of re-dissolving the iodine which coloured the surface of the skin. The disease began to give way immediately after the first application of the remedy, and the limb rapidly recovered, leaving only a few small ulcers where the larger vesicles had been situated. These were treated in the usual way.

We have since met with several cases like the above, and have treated them in a similar manner, with equal success. Such cases are some of the worst that can present themselves, for, unless soon checked in their career, most extensive sloughing of the cellular membrane takes place; large and numerous openings form in the integuments, and the patients are almost sure to sink, either from the violence of the inflammation and of the constitutional disturbance caused by it, or else from the great discharge which follows so extensive a destruction of parts.

In cases of this description, it is generally beneficial to apply a bandage round the limb as soon as the inflammatory action has entirely subsided ; for this will serve to support the weakened vessels until their contractile properties shall have been recovered, and to promote the absorption of the morbid deposite.

A gentleman, aged about 60 years, rather stout, presented the following symptoms; the right leg and foot were swollen to at least double the size of the left : the swelling extended to above the knee ; the skin presented a glossy, shining appearance; but its colour was rather pale ; or, at any rate, was hardly redder than natural : the limb pitted very considerably on pressure, and the integuments did not recover their level for some time after the removal of the pressure : there were several bullæ or vesicles about the ankle and the lower part of the leg—one was large and of a darkish colour : the general health did not suffer so much as might have been expected from the diseased condition of the limb, still the tongue was rather furred, and the pulse slightly quickened. The member was neither very hot nor very painful. Evaporating lotions had been employed for some days when the case presented itself, but the limb continued to swell more and more, and the vesicles went on increasing both in size and number. When it presented itself, the case was of four or five days' standing, but had become much aggravated within the last forty-eight hours.—The whole limb, from the middle of the thigh down to the tip of the toes, was painted with the tincture of iodine, in its full strength : it was ordered to be kept in an horizontal posture, and to be loosely covered over with a linen rag hose. At the end of twenty-four hours the member was decidedly smaller : the skin about the knee and upper part of the leg was loose, and drawn together in longitudinal folds, proving a diminution of the swelling : the smaller vesicles had dried up ; the larger ones had considerably diminished ; and the dark looking one had discharged itself. The application of the tincture was repeated, from the knee downwards to the toes. At the expiration of another day, the swelling was still more reduced : two or three of the larger bullæ had discharged themselves, leaving small superficial ulcers of quite a healthy appearance. After this time the leg was touched three or four times more with the tincture, reduced to about half its strength, and the two or three ulcerated spots were dressed with Turner's cerate. At the end of a week, there being some degree of œdema of the leg, a bandage was applied, and recommended to be worn until the vessels and the skin should recover their natural tone.

PHLEGMON.

The characters of phlegmonous inflammation are so well known to the profession as scarcely to require a description of them here. The disease generally commences with pain and a sensation of throbbing in the part, before any redness is apparent. The reason

of this is, that the seat of disease is entirely under the integuments, in the cellular membrane ; and the malady makes considerable progress before the inflammatory appearance presents itself on the surface of the skin. The order of attack in phlegmon is the reverse of that in erysipelas ; for, in the latter, the skin forms the original seat of disease, and the parts underneath become affected by contiguity, or rather by *continuity of vessels.*

There is another fact worthy of notice which distinguishes the two maladies, namely, that the extent of the destruction of the cellular membrane in erysipelas depends upon the extent of the inflammation of the skin ; whereas, in pure phlegmon, the extent of cutaneous redness is determined by that of the inflammation of the cellular tissue underneath. When the skin constitutes the seat of disease the inflammation spreads rapidly and widely, by continuity of tissue ; and as it dips down into the cellular membrane by continuity of vessels, thereby giving rise to the variety called " phlegmonous erysipelas," the latter membrane necessarily becomes very extensively affected. In phlegmon, on the contrary, the agency of the morbific cause is exerted on the cellular tissue—a tissue not prone to stretch out its maladies far—and the skin, being only secondarily affected, presents only a limited extent of inflammation, corresponding to the extent of disease underneath.

In pure phlegmon the cellular tissue shows the same disposition to die, or to resolve itself into purulent matter, as in phlegmonous erysipelas ; only that in the former variety of inflammation the cellular membrane determines the extent of its own affection, by circumscribing it within the limits of an abscess. The destruction of the tissue is generally limited, and a boundary is soon formed between the healthy and diseased parts. With regard to phlegmon, indeed, we may say that its invariable tendency is to end in an abscess, unless the vessels recover their normal tone by the efforts of nature, so as to induce the inflammation to terminate in resolution ; or unless it be checked by the interposition of art ; for we doubt whether this variety of the disease ever ends in absolute gangrene, properly so called. It is true that it may, and does, cause the death of the part immediately affected, so as to occasion sloughing of the cellular membrane ; but such sloughing is always of limited extent, and is not attended by the dark discoloration of the living parts, especially of the skin, and by cutaneous vesication, which characterise gangrene.

The redness in phlegmon is not so florid as that which the skin presents in erysipelas, and does not so entirely disappear on pressure. This is accounted for by the fact, that in simple erysipelas the vessels which are enlarged are those of the skin only, so that the pressure of the finger puts a stop to the circulation through them for a moment, and leaves the point pressed upon free from blood ; whereas in phlegmon the vessels chiefly enlarged are more deep-seated, so that, although pressure on the surface may obstruct the circulation through the capillaries of the skin, still the redness

will show itself from the vessels situated beneath the integuments.

It has been already stated that a throbbing pain usually precedes the redness and swelling in phlegmon, because the tissue originally affected is beyond the reach of sight. Increased heat, also, generally precedes the visible phenomena of the disease. Sometimes, indeed, when the part affected is situated very deeply—that is, when the inflammation is in a part of the cellular membrane situated low between the muscles—a portion of the tissue is destroyed, and an abcess is formed, before any external signs of inflammation show themselves. The integuments do not begin to inflame until the matter has worked its way some distance towards the surface, so as to discharge itself through the skin.

The topical remedies usually employed in phlegmonous inflammation, are leeches, and evaporating lotions: and, occasionally, poultices and fomentations. These are medicated with anodynes when the pain is very severe. Scarification of the inflamed part is sometimes resorted to; also the formation of an eschar over the part with nitrate of silver. These means are all good in their way, and are the most efficient—indeed the only ones—which have been used hitherto. But the inflammation will be subdued by the tincture of iodine much more quickly, and with greater certainty, than with any or all of these means.

In what manner the influence of the tincture reaches the vessels, in deep-seated inflammation of the cellular membranes, we do not profess to be able to explain, but that the remedy *does* exert an influence upon them is perfectly certain. In cases where pain and throbbing only exist, and where the inflammation has not yet made its appearance on the skin, it will generally be found that a single application of the tincture, in its full strength, and thickly painted over the seat where the pain is felt, will at once check or cut short the disease. A sensation of warmth, and probably some degree of smarting, will be felt in a few minutes in the part to which the remedy has been applied: this may continue for an hour or two; and when it ceases, the original pain also will generally be found to have ceased. However, it is safer to repeat the application, though no more pain or throbbing be felt; for no harm can arise from so doing. We feel satisfied that in many instances where suppuration had commenced, repeated applications of the tincture has not only checked the progress of the inflammation, but has also caused the matter already formed to be absorbed.

Nevertheless, when the seat of disease is *very* deep among the muscles, especially in the thigh, or about the loins, it is doubtful whether any impression would be made upon the inflammation by the local application of the remedy: we say it is doubtful, because we possess no facts either affirmative or negative of the proposition. Affections of that description are often very obscure in the first part of their course, and they frequently form abscesses before their real character is discovered. However, from our experience of the pro-

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perties of the tincture of iodine in promoting absorption of morbid deposite, we would trust to its employment in cases of this nature in preference to any other topical application.

When the inflammation takes place nearer the surface—that is, in the cellular membrane which intervenes between the integuments and the muscles—the redness very soon appears externally, and the disease presents from the beginning those characters which are distinctive of genuine phlegmon. Such cases are to be treated in the same manner as phlegmonous erysipelas. The tincture is to be applied the first time in its full strength. After the first application, the inflammation will be generally found, at the expiration of twenty-four hours, nearly subdued. The skin, which was before tense, will appear loose and wrinkled, and the cuticle beginning to peel off. If there should be no matter formed underneath, the remedy may be diluted to half its strength for the second application; but if pus exists under the integuments, it is desirable to let the tincture remain of its full strength, and its application be repeated daily, until the matter shall have been all absorbed, or else until it shall have worked its way to the surface, and discharged itself, or been let out, through the skin.

A robust, healthy looking young woman, about 20 years old, applied in March, 1834, with phlegmonous inflammation of the right leg. The disease commenced about the middle of the leg, on the outside, over the fibula. The skin was now inflamed over a great part of the leg: it was of a deep red colour, very tense, and very hot to the feel. The limb was a good deal swollen, but no matter appeared to be formed. The pain was very severe, accompanied by a throbbing sensation. The pulse was quick; the tongue whitish; thirst, and other febrile symptoms. The inflammation was "spontaneous," and of four days' standing. It had been treated with Goulard lotions, which rapidly dried when applied to the part, but which neither alleviated the pain nor appeared to reduce the temperature beyond a minute or two after each fresh application. The tincture in full strength, was applied all over the leg, from the knee down to the instep, and the limb was ordered to be kept in a horizontal posture. No general treatment was had recourse to. A few hours after the application, the sensation of pain and throbbing almost altogether ceased. Next day the swelling had considerably abated; and scarcely any more signs of the disease remained than a feeling of stiffness in the leg, and a slight soreness on pressure. The tincture, diluted to about half its strength, was again applied, and the limb was allowed to rest for two or three days; which completed the treatment of the case.

We could recite at least a score of cases analogous to the above; but one is as good as a hundred in illustration of a principle. It is possible that the remedy may fail in some instances, but, if properly and prudently applied, cases of failure will be very rare; by failure, we mean where the inflammation runs on and forms an abscess in spite of the remedy. We have not yet met with such a

case—that is, a case of superficial phlegmon where the tincture was applied before matter had begun to form : such a case of failure has not occurred to us.

In May, 1838, a strong, healthy man, about 35 years old, had a thorn run into the outside of his thigh, about midway between the hip and knee, in passing through a thick hedge. He took no particular notice of the accident at the time. The part, however, continued painful; and three days after, it began to swell a little, and to inflame. He kept poulticing it for three or four days longer, but the inflammation went on, rapidly increasing in violence, and extending over a great part of the outside of the thigh. The limb was now very red, hot, and painful ; much swelled ; hard to the feel, and leaving no pit, but a momentary paleness, upon pressure with the finger. The heat and pain were excessive : the latter was of a throbbing nature, corresponding with the contractions of the ventricles of the heart. There was a considerable degree of general fever. It was doubtful in this case whether suppuration had not commenced, for something like an obscure fluctuation could be distinguished at the point where the thorn had entered.—The whole thigh was painted over with the strong tincture, all the way from the hip and groin down to the knee. After getting dry— which it did in two or three minutes—the application was repeated three or four times to the outside of the limb, especially over the part which had suffered the accident. Ten grains of calomel, followed by a saline cathartic, were ordered to be taken immediately. About a quarter of an hour after the application, the limb began to feel very warm—a warmth congenial to the feeling compared with the heat and pain experienced before. This warmth was soon succeeded by rather a severe smarting, which continued for three or four hours. When the smarting ceased, the original pain, also, for the most part, was gone. The next day after the application of the tincture, the outskirts of the inflammation had all disappeared, leaving the skin wrinkled, and the cuticle beginning to desquamate. There still remained a hardness, and soreness on pressure, with a certain degree of swelling, extending a few inches round the point where the injury had been received ; but the throbbing pain had entirely left. The undiluted tincture was again applied to the hard part, and carried some distance beyond the hardness. The application was repeated daily for four days, which served to complete the cure.

In cases similar to the last, but where suppuration has gone on to some extent, the iodine may not succeed in producing an absorption of all the purulent matter deposited ; but it will exert an extraordinary power of confining the suppuration within narrow bounds. It almost immediately stops the inflammatory process, so that no more destruction of the cellular membrane takes place, and the line of boundary between the dead and living parts of the tissue affected is soon determined. In such cases, when an abscess does form, instead of having a cavity containing several ounces of pus

—as we generally find to be the case where the treatment has been by poultices, &c.—perhaps not an ounce will escape when the abscess breaks, or is opened.

EXTENSIVE SLOUGHING OF THE CELLULAR MEMBRANE.

Severe cases of phlegmonous erysipelas, especially of the lower extremities, are frequently followed by very extensive sloughing of the cellular membrane, which protrudes through ulcerated openings in the skin, leaving large vacancies between the integuments and the muscles. While this mischief is going on in one part, the inflammation often continues to spread progressively, so as, now and then, to involve a whole limb. If the patient does not die under the violence of the disease, in these cases, he generally soon sinks under the enormous purulent discharge which takes place as its consequence.

In cases of this description, almost the only topical remedies in use are large poultices and fomentations. It is a question whether these be not more injurious than beneficial, for by increasing the discharge, without being capable of checking the inflammatory process, they must tend to diminish the little strength which remains with the patient.

Under these circumstances, the tincture of iodine is a most valuable acquisition as a remedy in these grievous affections. It not only has the advantage of being easily applied, without disturbing the posture of the patient, but it also has the property of at once arresting the progress of the inflammation, so as to give the living parts a chance of casting off the dead slough.

In the summer of 1837, a man, aged 75 years, received a kick on the shin. The part became inflamed, and the inflammation proceeded from bad to worse, in spite of surgical treatment under the management of a skilful practitioner, until the whole leg and thigh became involved in one mass of disease. When we saw him in consultation, the limb, all the way from the toes to the groin and hip, was enormously enlarged. The skin was intensely red and glossy, with the exception of several dark coloured vesicles about the lower part of the leg. In different parts of the limb there were several ulcerated openings in the integuments, through which strings of dead cellular membrane protruded. The discharge through these openings was very great. Indeed, it appeared as if the integuments of the whole member had separated from the muscles, leaving an empty space between. The constitutional disturbance was as great as it could well be consistent with life. In a word, the patient, considering his great age, and the extensive destruction of parts, appeared quite in a hopeless state. The tincture of iodine, of full strength, was thickly painted over the whole limb —thigh, leg, and foot ; and the application was repeated daily. At the expiration of twenty-four hours there was some slight amendment : on the third day the amendment was very decided. The

march of the inflammation had been checked : no more bullæ had
formed, and most of those which existed before, had discharged
themselves, leaving small, healthy looking ulcers on their site.
The only doubt now was as to the strength of the patient to bear
the enormous discharge that must take place from the excavations
which ran in all directions between the integuments and the mus-
cles of the leg and thigh. After the first four or five days, the
tincture was applied every second or third day, until all the dead
membrane was thrown off; and as soon as that object had been
accomplished, it was still applied occasionally to any spot which
showed a disposition to inflame. As soon as the sloughing had
ceased, the openings in the integuments were dressed with simple
dressing, and gentle pressure was applied to the limb, with the
view of promoting adhesion between the parietes of the excavations.
By proceeding upon this plan, the recovery of the patient was ulti-
mately secured.

July 15th, 1833, a thin, but healthy man, aged about 58 years,
was felling a tree. The tree bounded over, and the stem fell upon
his foot, lacerated the soft parts over the ankle and all along the
back of the foot, exposing very extensively the extensor tendons of
the digits. Independently of the extensive laceration, the foot and
ankle suffered very severe contusion from the weight of the tree.
There was also a fracture of both bones of the leg, about three
inches above the ankle. The fractured bones having been set, and
the lacerated parts having been brought together as well as could
be done under the circumstances, and retained so with adhesive
plaster, an evaporating lotion was ordered to be kept constantly
applied to the foot and ankle. The lotion was continued for three
days. The limb did not swell much, nor did there appear to be
any considerable increase of its temperature, although the weather
was hot ; but on removing the dressing, on the 18th, the integu-
ments and wound presented a dark, livid, sloughing appearance,
and the whole foot looked as if gangrene must necessarily take
place. There was also present that peculiar constitutional dis-
turbance which usually attends gangrenous affection of any part.
The tincture of iodine was immediately applied over the foot and
ankle—the parts were coated over three or four times with it. The
internal treatment consisted simply of common saline solution, with
a small quantity of sulphate of magnesia. By the next day the
foot presented a much more favourable appearance. It was quite
evident that the gangrenous tendency had ceased. The greater
portion of the integuments, whose life was supposed to have been
entirely gone, showed indications of vitality. Those parts which
had actually lost their vitality began already to exhibit a disposition
to separate from the living part. The tincture was repeated daily
for three or four days, until the vital part cleared itself of all the
slough ; which it did most rapidly : the remedy, a good deal diluted,
was then applied every two or three days to the surface and round
the edges of the ulcer, in order to quicken the growth of granula-

tions. Suffice it to say that the ulcer healed very rapidly, and that the patient was restored to his occupation, free from lameness, quite as soon as if there had been only a simple fracture of the leg.

We must be pardoned for again repeating the observation, that these are not casual, solitary instances of this description of disease where the tincture of iodine has proved beneficial : it is almost uniformly successful, so far as our experience tends to prove : the exceptions are cases where some extraordinary gangrenous disposition exists in the system—as we now and then find when amputation of a limb is performed before the dead parts have separated, and where gangrene immediately commences in the stump ; or where the sloughing has already extended so far that the system does not retain sufficient strength to restore the lost parts.

ACUTE INFLAMMATION OF THE JOINTS.

Inflammation of the synovial membrane of the joints—especially of the larger joints—requires very prompt treatment, otherwise permanent organic changes take place, so that the free motion cannot be restored. The pain is generally severe in acute inflammation of this tissue ; and the tenderness is often so great that the patient cannot bear the part to be touched. The soft parts covering the joint become swollen, and the inflammation presents itself externally on the skin. The joints by far the most liable to this kind of affection are the knee and hip ; and as the tissue originally affected is endowed with but a small degree of sensibility, the disease frequently makes considerable progress before any particular notice is taken of it. This is proved by the fact, that a slight uneasiness, or a small degree of tenderness, often exists in the joint for several days, or perhaps a week or more, before the patient is laid up ; and that, when the disease has once arrived at a certain stage in its progress, it runs on very rapidly, so as to produce suppuration within the capsule of the joint, unless promptly met by remedies.

The topical remedies usually employed in this affection, are local abstraction of blood, either by cupping or leeching, or both ; evaporating lotions ; poultices, warm or cold, according to the views of the practitioner ; and, occasionally, fomentations.

Now, the tincture of iodine has been employed very extensively, both at the General Infirmary and in private practice, in this disease, and has been found a much more efficacious remedy than any of those in common use. It is necessary, however, to state, that no disease for which the iodine has been employed requires so much discretion on the part of the surgeon as the one under consideration. If used too strong at first, or applied too frequently, it may give rise to inflammation of the integuments, and cause, or add to the puffiness of the soft parts external to the joint ; but we have not known it in any one instance to aggravate the internal inflammation. We speak now more particularly of the knee joint. The texture of the patient's skin must serve to guide the practitioner, in

a great measure, respecting the strength of the tincture and the frequency of its application. It should be at first diluted to about half its strength, or more, if the skin be of a very delicate texture; and, if required, its strength may be gradually increased according to its effects. It is seldom that the remedy produces any irritation of the skin in other parts of the body; and with regard to the knee, our remarks are intended more to put the practitioner upon his guard against what *may* happen, than to inform him of what *will* happen. Should any irritation or inflammation of the integuments occur, it will be very readily subdued by a simple evaporating lotion, composed of one part of spirit of wine to eight or ten of water.

The tincture, diluted, may be applied at once all over the inflamed joint, with perfect confidence that not only no *mischief*, but that *good*, will be the result. But when the disease has been pretty far advanced, and where the swelling has been considerable, we have generally preferred leeching the joint first, and then, a few hours after the bleeding has ceased, to apply the tincture. Whether by getting into the leech bites the remedy exerts a greater influence on the internal vessels of the joint, we do not profess to know, but the fact is that the application of leeches, in this species of inflammation, previous to the employment of the tincture, tends greatly to assist the good effects of the latter. The remedy will generally require to be applied every day, for two or three times; then every other, or every third day, according to circumstances; the practitioner exercising his discretion according to the condition of the part, and the effect of each application. If, in the intermediate time of the applications, the part should acquire an increase of temperature—as it sometimes does very suddenly, without any evident cause—it will be useful to lay over it a layer of rag soaked in spirit of wine, or in a simple spirit and water lotion. This application will not interfere with the repetition of the iodine. But no lead or zinc lotion, or one medicated in any way, should be employed.

When the hip is the joint affected, leeches should be applied to the groin and behind the great trochanter; and after the bleeding has ceased, the whole of the upper part of the thigh, the hip, and the groin should be well painted over with the tincture, of its full strength. The application, as in all other cases, should be repeated according to circumstances.

Having illustrated the principle and mode of application of the remedy, it is unnecessary to occupy the time of the reader by a detail of cases of this species of inflammation, for the doing so would be only a repetition of the same mode and principle already just stated. It is also assumed, as a matter of course, that, in this disease, as well as in all other local affections, no general treatment calculated to assist in the subduction of the local malady has been neglected.

INFLAMMATION OF THE BREAST.

The inflammation of the breast which so frequently takes place soon after delivery is of the pure phlegmonous kind, having its origin and seat in the cellular membrane pervading the mammary glands. Its commencement and progress are attended with heat and throbbing pain, and it terminates, if not in resolution, in a purulent abscess, like that proceeding from common phlegmon. The collection of matter is generally very great, attended with a good deal of constitutional disturbance, and the abscess usually opens by a large hole, denoting much sloughing of the integuments and of the cellular membrane within.

In three cases out of four, or even in a larger proportion, acute inflammation of the mammæ runs on to suppuration under the usual plans of treatment, and the abscess is generally upon so large a scale that the gland never afterwards recovers its natural function. The topical remedies in common use are leeches, lotions, and poultices. The popular remedies are of a more stimulating kind, and are applied in the form of embrocations, which, it cannot be denied, are oftener followed by success than the professional ones.

Although generally very deeply situated among the glands, inflammation of the breast is not beyond the reach of the influence of the iodine. If applied before matter has actually commenced to form, the tincture will prove successful in the great majority of cases. When suppuration has already commenced, the application will materially confine the mischief, probably by subduing the inflammation surrounding the abscess; and instead of having an enormous discharge of matter, from a cavity occupying nearly the whole of the breast, perhaps not more than an ounce or an ounce and a half will come away on the breaking of the abscess.

As soon as it is discovered that inflammation has commenced, the tincture, in full strength, should be applied extensively over the part affected. When the disease originates very deeply among the mammary glands, the remedy should be made to cover the whole breast. The application should be repeated next day, equally strong, unless the smarting from the first should have been severe: if so, then the tincture ought to be diluted. At any rate, the breast should be painted over with it daily, until the pain and redness shall have ceased, the strength being regulated according to its effect on the skin. Even if suppuration is known to be going on, it is still expedient to pursue the same course, because the remedy will tend greatly to limit the extent of the abscess, and will accelerate its bursting. When the abscess has burst, or has been opened, a poultice should be applied to the part, and continued as long as any discharge exists; but an occasional application of the tincture, even after the bursting, will be found to aid the cure very materially.

Three cases of this description have been under treatment within the last six months ; and, during the last five years, several cases have occurred, in some of which suppuration took place, but always small in quantity. In the great majority the inflammation was checked before any purulent matter was formed, or when it was so small in quantity as to be again absorbed under the use of the remedy.

GOUT.

The inflammation of gout is universally considered as dependent upon constitutional causes. No doubt, the morbific cause of the disease is conveyed to the local seat of affection through the medium of the system, and the functions of other parts suffer from it besides those which present themselves externally. But the most unbearable symptom of the disease is the *pain* in the local seat of inflammation ; and the violence of this is generally such as greatly to aggravate any constitutional symptoms that may exist. Previous to the appearance of the local inflammation, there is generally an uneasiness about the pit of the stomach ; nausea ; general languor, attended with a disposition to irritability, both of mind and body ; darting or shooting pains in different parts of the body, &c. When the local pain comes on, the foregoing symptoms become drowned in a general fever, which continues, more or less, as long as the local affection exists.

The local remedies usually employed for the removal of the pain and inflammation of gout, may be divided into two classes : first, professional ; second, popular. The former are the same as those used in other local inflammations, namely, leeches, evaporating lotions, fomentations, poultices, &c. The latter consist in the application of hot flannels, and other hot things ; stimulating embrocations ; stimulating plasters, &c. The object of the first class is to *prevent* inflammation from taking place, by means of antiphlogistic remedies : the object of the second class is to *promote* inflammation and swelling, because experience has proved that as the integuments swell and inflame, the pain diminishes. The virtues, and want of virtues, of both classes of remedies are so well known to the profession, and to those who are subject to the disease, as to render any remarks upon them here unnecessary.

The curative effects of the tincture of iodine in the pain and inflammation of gout can be appreciated by those only who have witnessed them, or those who have received the benefit of the remedy. We have generally found one or two applications remove the pain almost entirely. We usually dilute the tincture to about two-thirds its full strength ; and if the part affected be the foot, we paint it and the toes well over, all the way from the ankle ; or from higher up the leg if the ankle itself suffers from the disease. The application is repeated next day if any pain, redness, or swelling remains. In fact the disease is treated like common phlegmonous

inflammation. When the malady has fixed itself in the fingers and hand, the treatment is the same : the whole hand, fingers, and wrist are brushed over, and the application is repeated as long as any trace of the disease remains.

A gentleman of our acquaintance (who has never had a regular attack of gout, but has had many threatenings of it,) whenever he experiences pain in the ball of his great toe, with tenderness on moving the joint, immediately applies the tincture very liberally to the seat of threatened mischief. By so doing he has hitherto warded off the attacks ; and the constitutional derangements accompanying these threats have been rectified by simple saline aperients.

A gentleman, aged about 50, who had, usually, for many years been obliged to lay up for several weeks each year with the gout under the old established mode of treatment, has had, of late years, the paroxysms reduced to a few days only. The local affection has been always preceded by a good deal of gastric derangement, and the pain in the feet, at the commencement of each attack, has been excessive. The pain, however, has been relieved in a few hours by the application of the tincture ; and even the redness and swelling (when the disease has been allowed to proceed so far) have been soon reduced ; and, aided by general treatment, every paroxysm has been of late years subdued in a few days.

A man, aged about 45, of stout make, but of rather unhealthy constitution, has been much subject to gout of late years. The pain in the feet, as the paroxysms come on, is excessive. Before we began to attend him, the feet used to inflame, and swell considerably, so as to confine him for weeks. Within the last few years, the application of the tincture to the feet, and a few doses of colchicum internally, have set him up in a few days. The pain has been usually subdued in a few hours.

In very many cases of anomalous pains of the joints, supposed to be gouty or rheumatic, unattended by inflammation, the effect of the tincture of iodine has been very noted. In such cases it ought generally to be used in full strength, unless the texture of the skin be delicate. It first causes a sensation of warmth, amounting in most instances to smarting ; and it commonly follows that when that sensation has ceased, the original pain is no longer felt ; or, if felt, it is in a much lower degree than before the application of the tincture.

CHRONIC INFLAMMATION AND ENLARGEMENT OF THE JOINTS.

This affection constitutes generally a large proportion of the surgical cases admitted into hospitals. The disease varies in degree from that state commonly called "white swelling," down to a slight thickening of the soft part, and tenderness on moving the joint. Its cause may also vary : sometimes it is connected with a scrofulous state of the system ; at other times it is produced by some slight

accident to the joint; whereas it often comes on without any accountable cause.

When the large joints, such as the hip and knee, have formed the seats of affection, the treatment has usually been local bleeding, followed by blisters or setons. In fact, all the remedies commonly employed in acute inflammation, with the addition of stimulating embrocations, plasters, and mercurial inunctions have been at different times put in practice in this obstinate malady.

Iodine, also, has been employed in enlargement of the joints, especially in cases accompanied by a scrofulous condition of the system, from the supposition that the remedy possesses some specific influence over that disease. We have never had reason to believe that it does possess any such influence, any further than that, as a topical remedy, it will subdue scrofulous inflammation in the same way as it subdues any other local inflammation. The iodine has been generally employed in these cases in the form of ointment. It is not only objectionable in that form on account of the friction tending to increase the pain and irritation of the joint, but also because its effects are nothing like so beneficial as when applied in the form of tincture, or of ioduretted hydriodate lotion.

To the large joints, such as the hip and knee, we generally apply several leeches before the employment of the iodine. Having done so, the tincture, usually diluted, is applied very extensively over the affected joint, and repeated every two or three days, according to its effect on the skin. Should any preternatural heat occur in the part, a layer of rag, soaked in spirit of wine, or in a simple spirit lotion, should be laid on it, the same as directed to be done in the acute form of the disease.

This plan is to be persevered in for a period limited only by the duration of the disease. An amendment will generally be found in a few days to have taken place; and it will go on progressively, but in many instances slowly, until the motion of the joint is restored, as far as art can restore it.

When the enlargement has been in the ankles, or wrists, and of long standing, we have generally preferred the iodine lotion, even to the tincture. This is the most ready form of the remedy in cases like those of out-patients at hospitals, where the practitioner has not an opportunity of frequently witnessing the progress of the cure. The strength of the lotion must be determined by the discretion of the surgeon. A piece of rag should be soaked in it, and laid round the affected joint, and the application should be repeated two, three, or four times a day, according to its effect on the skin.

This plan of treatment has received a long and extensive trial, and it has succeeded very far beyond the methods usually adopted in affections of this nature.

INFLAMMATION OF THE ABSORBENTS.

The first, and worst, case of inflamed absorbents in which the

tincture of iodine was used, was that of a gipsey-man, aged about 30, in 1829, who had been bitten on one of his fingers by a horse. Some purulent matter from an abscess in another horse got into the wound. The part soon inflamed, and the inflammation rapidly extended along the course of the absorbents up to the axilla. When we saw him the disease was of a fortnight's standing. There was an abscess discharging at the bend of the arm; another about the middle of the upper arm, and a third in the axilla; and there was a wide path of inflammation traceable all the way from the wound to the axilla, along the course of the absorbents. The man was reduced to a mere skeleton.

The tincture of iodine, of full strength, was freely applied along the inflammatory path, and over the abscesses; and the application was repeated daily. Common dressing was then applied to the abscesses. The inflammation, by this plan, was subdued in two or three days, and the patient was well in a fortnight.

We might detail a dozen or more cases of inflamed absorbents, from slight injuries to the toes or fingers; from the pressure of the shoes upon corns; from the too close cutting of corns, and from other causes, where the tincture has been applied, and uniformly with success. Indeed, one or two applications generally suffice to subdue the inflammation of the absorbents; but we have usually continued daily to touch the original source of the mischief—that is, the wound, or corn, or bunion, or whatever the cause may have been—for some days after the inflammation has disappeared.

CARBUNCLE.

In November, 1836, a man whose constitution has been already noticed, as being subject to gout, had a regular and well formed carbuncle on the back of the neck. He allowed the disease to go on—applying poultices, &c. in the mean time—for ten days, before he applied for surgical aid. When we saw him there was a large carbuncle in the middle of the nape, having a great number of small openings on the surface, and being surrounded by a hard, dense, red swelling. The skin was quite tough and leathery. The general health was suffering very much.

The usual practice in these cases is to make a crucial incision in the carbuncle, and then continue the application of poultices until the part is restored to its normal state, or until the patient dies; doing all necessary things towards improving the general health.

The tincture of iodine, of full strength, was applied very thickly over the inflamed surface, as well as over the carbuncle. On the next day the inflammation was found considerably diminished. The application was repeated as before. On the third day the inflammation was nearly gone. The skin corrugated, and the cuticle was desquamating all round the carbuncle: but the carbuncle itself remained much in the same state, having a great number of small openings on its surface, through which the matter within

could find no free exit. As there evidently was a considerable quantity of dead cellular membrane which must be discharged before the abscess could get well, a single transverse incision was made through the carbuncle. The tincture was then repeated daily, and having allowed an hour to elapse after its application, a small poultice was put on, for the purpose of keeping the abscess moist. The dead cellular membrane was cast off in three or four days, and the cavity left by it filled up rapidly by granulations.

Last winter, a labourer, aged about 40 years, of a thin, irritable, unhealthy look, applied for relief for a boil (as he called it) on his back. He represented it as having been coming on for a fortnight, during the whole of which time he had poulticed it. He found that his health was fast giving way, and that the boil was daily getting larger and more painful, he therefore presented himself for surgical aid.

On examining the back, there was found on the left loin a large carbuncle, having a number of very small openings on its surface, and being surrounded to a considerable extent by an areola of inflammation. The part was swelled, and felt as hard as a board. The skin was of a dark red colour, and communicated a tough, leathery feel to the fingers. The health had suffered considerably within the last week.

There was also an incipient boil on the left shoulder, just over the blade bone, having precisely the same characters as the one on the loin at its commencement. Two applications of the tincture served entirely to dispel this young carbuncle.

A crucial incision was made in the carbuncle on the loin, and then the tincture, of full strength, was thickly laid on it, as well as on the extensive areola of inflammation surrounding it. A small poultice was applied to the abscess, with the view of keeping it moist. The only general treatment was a tea-spoonful of Epsom salts every morning, in half a pint of water. Next day the inflammation had considerably subsided, and the leathery hardness of the skin surrounding the carbuncle was very nearly gone. The man felt already much improved in health : he had had a good night's sleep, which he had not before enjoyed since the local disease had made its appearance. The tincture was again applied, both to the carbuncle and to the surrounding skin. After the second day it was not found necessary to paint the skin, for no inflammatory action any longer existed. The carbuncle, however, was touched daily for some time, in order to enable it the sooner to cast off the dead cellular membrane, and to form granulations. In a few days the slough was discharged, leaving a very large, deep cavity, which, however, filled up very rapidly under the occasional application of the tincture, diluted to about a third of its full strength. The man was fit for work in less than a fortnight from his first applying for surgical aid.

It may be stated here, that the remedy is equally applicable to common boils. It has also been used in several cases of bubo—

some dependent upon chancre ; others upon gonnorrhœal irritation—and its good effects have been uniform. If applied to them in their incipient state, before suppuration has actually commenced, it will *generally* cut short their march. If applied after the commencement of suppuration, and previous to their bursting, it will subdue the surrounding inflammation, and confine the abscess within a very narrow space. If applied after the bursting, it will materially accelerate the removal of the hardness and inflammation surrounding the cavity of the abscess. These are real facts—facts easily tested by trial.

LUPUS, OR NOLI ME TANGERE.

This is a disease kept up apparently by some specific cause, which induces it to go on progressively, destroying in its march the integuments and parts situated underneath. It usually commences on one of the alæ of the nose, or side of the cheek close to the nose ; or else on the lips, especially the lower one. It generally begins in a pimple or small tubercle, which ulcerates, and the ulceration spreads in a continuous manner, eating up in its course the skin, alæ of the nose, or other parts beneath, to a considerable depth.

The principal remedy employed for this destructive malady is arsenic, both administered internally, and applied externally, so as to cause sloughing of the diseased part. Nitrate of silver has been also used with the same view. Ointments made with different preparations of mercury, as well as pitch and sulphur ointment, have all been applied in their turn.

September 10th, 1829, a respectable mechanic, aged about 36, had an eating ulcer on the left ala of the nose, extending some distance on the side of the cheek. The disease had crept up the nose as high as the nasal bone, and had eaten right through the cartilage, so as to produce a slit into the nostril. It was creeping on fast along the side of the cheek. The part was excessively painful. The disease was of some weeks' standing. Various applications had been tried before we saw him, and he had consulted some noted London surgeon; but the malady was steadily progressing in its march.— The tincture of iodine, of full strength, was applied over the surface of the ulcer, and to some distance round ; and the ulcer was then dressed with ointment containing hydriodate of potass. The disease made no further progress. In a few days an amendment was quite perceptible. The ulcer was treated in the same manner daily until the 30th : after that period the tincture was only applied every two or three days. On the 20th of October the patient was discharged, cured.

In the same year, a labourer, aged about 40, had an eating ulcer on the side of the left cheek, near the nose. It had consumed the integuments to the extent of a crown piece; but in the middle of the part destroyed there was a kind of rough skin forming, which was situated below the level of the old integuments. Between this

and the outward edge of the disease there was an ulcerated space exceedingly painful. The tincture of iodine was applied daily over the ulcer and surrounding skin: no further dressing was employed; the part being left exposed. No internal remedies were used. The malady ceased to spread after the first application. In three weeks the case was discharged, cured.

The remedy has proved equally successful in two or three cases of the same disease affecting the lips, in its incipient stage:

It is proper, however, to state that the remedy failed in one instance at the infirmary, although assisted by the internal use of the arsenical solution. This was the case of a little girl, about twelve years old, whose nose, and the side of whose face, were affected by the disease. In this case, whenever the iodine was employed, the march of destruction soon stopped, and the parts invariably put on a more healthy appearance; but whenever any other application was used the affection increased.

MALIGNANT ULCERS OF THE TONGUE AND TONSILS.

Ulcers of a very troublesome kind often form within the cavity of the mouth. These are occasionally tainted with syphilis, especially when they attack the tonsils, and velum of the palate. Frequently, however, even these parts become the seats of destructive ulcerations, in the production of which syphilis has had no share. We were greatly puzzled respecting the treatment of affections of these seats before we began to employ the iodine; but since then the treatment has been easy enough, and almost uniform in its success —indeed, we may say quite uniform as far as our experience goes.

September 7th, 1829, a youth, aged 16 years, had the left tonsil very nearly all destroyed by ulceration, which was still proceeding. There was also ulceration going on in the uvula and back edge of the velum. The right tonsil was considerably swollen, and the whole of the soft palate was much inflamed. The tonsil began to ulcerate three weeks previous, and the disease was going progressively on, destroying the soft parts in its course. His general health was suffering a good deal. He had been under medical treatment since the throat first became bad. He denied having given occasion for any syphilitic affection. The tincture of iodine was applied with the brush all over the palate, tonsils, and uvula; and the application was repeated daily. The only internal remedy was the iodureted hydriodate solution, in doses of ten drops twice a day, in water. We find, by our notes, that the patient was dismissed, cured, on the 20th of the same month.

A butcher, aged about 35, healthy looking, though not very stout, applied, November 30th, 1829, for relief to an affection of the tongue. The disease had been coming on for some months, and he had been under treatment for it without finding any benefit. The tongue was altogether a good deal enlarged, and several parts of it were indurated deeply into the substance of the organ. The

surface of the indurated points was ulcerated. The ulcers were, each, small in extent; but they were very numerous, and extremely painful at times, and very tender when they came in contact with the teeth, or the roof of the mouth.—The tincture of iodine, of full strength, was applied all over the tongue, and the organ was directed to be allowed to hang out of the mouth for two or three minutes after every application. The only internal remedy was the iodureted hydriodate solution. After the 5th of December, thinking that the tongue was well, the patient ceased to attend. Finding, however, that the disease threatened to return, he applied again on the 21st of January following (1830.) The same treatment was resumed and continued for a week only, when he found himself well, and left off coming. He has had no return of the disease since.

These cases are selected because they are among the first of the kind that were treated with the tincture of iodine. Many similar ones, and various other affections of the mouth have been since treated in the same way, with equal success.

SCROFULOUS SWELLING OF THE GLANDS.

In scrofulous constitutions, the hereditary malady generally shows itself externally in the lymphatic glands under the jaw and about the neck. Why it should bear a more intimate relation with the glands of these parts than with those of other seats, is one of those mysteries connected with the living structure which have not yet been fathomed. The commencement of the glandular enlargement in this affection is usually unattended with pain. The pain and soreness seldom come on until the integuments begin to inflame, from the internal pressure of the enlarged gland. When the abscess bursts, its contents are found to be a mixture of pus and cheesy or curdy substance. These affections very commonly run on to suppuration under the common plans of treatment, and when the matter has discharged itself by the bursting of the abscess, the part is usually slow in healing. It frequently happens that no sooner one place heals up than another breaks out, and there is often a succession of swellings and sores in various stages of suppuration and healing.

The topical remedies commonly employed in these affections are leeches ; lotions, generally medicated with acetate of lead or sulphate of zinc; salt and water, or sea water; and poultices after suppuration has been discovered to have commenced.

The tincture of iodine, applied over the enlarged gland, will much more frequently cause a dispersion of the swelling than any other remedy. If resorted to before suppuration has actually commenced, and used with discretion, it will, in a great majority of cases, check the swelling, and will ultimately promote the absorption of the morbid deposite. The same remarks will apply to these swellings as to common boils: even when suppuration has begun

before recourse is had to the tincture, or when it has taken place in spite of the tincture, still the application of the iodine is highly beneficial, in limiting the extent of the abscess, thereby limiting the size of the scar which is to follow. Moreover, when the swelling has burst, an occasional touch of the remedy will be found materially to accelerate the cicatrisation of the sore.

We have never had reason to think that the iodine exerts any *specific* influence over these swellings, as it undoubtedly does over that of the thyroid gland. It subdues inflammation of the lymphatic glands in the same way as it does inflammation of any other part, namely, by imparting a contractile tone to the capillary vessels, so as to restore the balance between the two functions of secretion and absorption.

WHITLOW.

A deep-seated whitlow, though originally occupying a small part of a very small member, is yet one of the most serious local affections, dependent upon acute inflammations, to which the attention of the surgeon is liable to be called.

This affection consists of inflammation of some part of the last phalanx of the fingers and thumb. It is sometimes superficial, being situated immediately under the skin. When this is the case, it soon forms a vesicle containing a serous fluid, or serum mixed with pus. After this has burst, or has been let out, it often leaves a little ulcer about the root of the nail, which proves very troublesome and difficult to heal.

When the disease originates in the deep-seated parts, such as the sheaths of the tendons, or the periosteum of the last phalanx, the pain is excessive, attended with the sensation of strong throbbing, together with increased heat; but the swelling in the finger is frequently very trifling for some days. The parts which first and most swell, are the hand, wrist, and arm; and the pain, which is very severe, extends along the member, up to the axilla. After a few days, the finger swells more, and some indistinct fluctuation may, perhaps, be felt towards the end of it, generally on the palmar side. Suppuration has now commenced, and unless the part be immediately—or even before this stage—laid freely open, the bone, especially the last phalanx, will be almost sure to die. The soft parts about the finger, hand, and wrist will swell enormously; matter will burrow in all directions under the fascia, and amongst the sheaths of the tendons; the integuments will ultimately ulcerate in various parts, and the dead fascia and cellular membrane will protrude in ropes through the openings. While this process is going on in the soft parts, the bones of the fingers are losing their vitality and becoming carious.

The local applications commonly used for this disease, are, a leech or two to the end of the inflamed finger, followed by a Goulard lotion, or a poultice, to the finger and hand: laying the part

freely open, down to the bone, and then poulticing it.   This should
be done without fail as soon as it is found that the inflammation
does not end in resolution.

As soon as the pain and throbbing of whitlow are felt to be com-
ing on, the whole finger or thumb (whichever it may be,) ought
immediately to be painted over with the tincture of iodine, of its
full strength.   In about twelve hours, the application should be
repeated, unless the morbid sensation has ceased, which is often the
case, even after the first application.   In every case, however, it
will be prudent to repeat the remedy two or three times, at intervals
of twenty-four hours.   Except where it was certain that suppura-
tion had actually commenced, we do not remember an instance in
which the tincture has failed to subdue the disease.   Whenever it
is suspected that matter exists, or even when that is doubtful, if the
inflammation does not give way in a few hours, a *free* incision
should be made into the part : the tincture should then be applied
over the finger, as well as over the hand if at all swelled ; and it
should be made to insinuate itself freely into the incision.   After
an hour or two have been allowed to elapse, a small poultice should
be applied to the end of the finger—confining it to as small an
extent beyond the incision as possible, its object being merely to
keep the wound from healing.   The same treatment should be
repeated daily as long as any vestige of the disease remains.

Within the last eight months we have had two fair specimens of
the destructive nature of this disease under treatment at the Infirm-
ary.   The two cases were so similar that one description will do
for both—indeed, for almost every neglected case of deep seated
whitlow.

In both these cases, the part originally affected was the little
finger.   The only difference in the two, when they presented them-
selves, was, that in one the palmar surface of the finger was dry
and black ; whereas in the other the whole finger was swelled to
three or four times its natural size, and it looked a complete mass
of sloughing cellular membrane and pus.   The hand was enor-
mously swollen and inflamed, with ulcerated openings here and
there, through which sloughs of dead membrane and fascia were
protruding.   The redness and swelling extended to the other
fingers, and up the wrist, as high as the middle of the arm.   The
pain was so great that the patients had had no sleep for many days.
The whole hand and fingers presented such a mass of disease that
it was impossible to determine the amount of mischief done to the
bones, any further than that the three phalanges of the little finger
were destroyed.   Poultices and fomentations, or soaking in warm
water, had been diligently used from the commencement of the
disease, but incision of the part had been neglected in both cases.
The hand was first washed clean of the poultice, in warm water,
and left exposed to the air for a short time, in order that its surface
might dry.   The tincture of iodine, of full strength, was then
applied thickly all over it, including the space from the middle of

the fore-arm to the tip of the fingers. After that, a thin piece of rag was thrown loosely round the part, and the hand put in a sling. The patient, in both instances, slept soundly the very first night after the application of the remedy. Next day the swelling was found much reduced, and there was only a remnant of the *pain* existing. The same treatment was repeated every day for about a week or ten days, when the inflammation was all gone, and the swelling was so reduced as to enable us readily to determine the extent of mischief done to the bones, and to render an operation easy. The finger was removed in each case, at the knuckle joint, and dressed in the usual way, only that at each dressing the wound and the whole hand were brushed over with the tincture. About three weeks after the operation each patient was discharged, cured.

CHILBLAINS.

The parts most subject to chilblains are the toes, especially the little toe. Those next most liable are the fingers, especially the little finger. The ears, nose, and cheeks, also, not unfrequently become chilled.

In this troublesome affection we find a species of inflammation without any heat or pain, for the most part. It is true that the part affected requires a temperature somewhat above the standard when it has been in a warm room, or kept near the fire, for some time; but that is very trifling, and even then the heat does not convey the same sensation as that of common inflammation of the same seat. It is also true that, under the circumstances just stated, a certain degree of pain is felt, but the sensation is more that of itching, and is quite different from that attending either phlegmonous or erysipelatous inflammation. Strictly speaking, the only elements of inflammation observable are redness and swelling. These are often present in a considerable degree of intensity—so much so, that the death of the part is by no means an uncommon result. Sometimes, however, an erysipelatous inflammation of the foot and leg proceed from the chilled part, and the case then assumes a new character.

We have already noticed that those parts are most liable to become chilled in which the velocity of the circulation is least. The vital contractility of the capillaries is reduced by the long continued application of cold, so that they become enlarged in capacity, and retain considerably more than their due proportion of blood. As the vessels continue to enlarge, the motion of the fluid becomes slower, until, at last, it ceases altogether, and the part ulcerates or sloughs.

Experience has taught people in general, that applications of a stimulating nature are the most efficacious in this complaint, some of the *professional* remedies, however, are still applied upon the antiphlogistic principle. But the most common applications are embrocations containing camphor, ammonia, oil of turpentine, and

other stimulating fluids; and, when the skin has ulcerated, ointments containing some of the gum resins form the usual dressings.

The best preventive of chilblains, with which we are acquainted, consists in immersing the parts affected every night in warm water, into which some common salt has been thrown. When the fingers are liable to chill, the hands should never, if possible, be washed in cold water during the winter months.

Scarcely a week passes in the winter that children with chilled feet are not brought for assistance—some with deep and extensive ulcerations about the heels and outside of the feet; and others with some of the toes sloughing off. The disease is usually checked in its progress by two or three applications of the tincture of iodine. The remedy should be applied, in its full strength, to the distance of some inches beyond the boundary of the inflammation, and should be repeated daily for some time. The affected parts should also be immersed every night in water as hot as the patient can bear. When the ulcers have assumed a healthy aspect, and the surrounding skin has lost its dark, livid, unhealthy colour, the strength of the tincture may be reduced, and its application repeated every two or three days only, until the ulcers have quite healed. The ulcers should be painted over with the tincture each time of its application, and then dressed with any simple ointment, or, in preference, ointment containing some resinous gum.

We stated that the chilled parts sometimes assume an erysipelatous character; and when this is the case they have a great tendency to run into gangrene.

A woman, aged about 70 years, had one of her feet much chilled throughout the winter and spring. She did not apply for surgical aid, but kept poultices and other popular remedies applied to the part affected. The weather having become suddenly hot, and she being obliged to stand a good deal upon her legs during two or three days, the foot began to inflame round the ulcer, which was situated on the outside of the little toe, and the inflammation extended rapidly up the leg. When we saw it a couple of days after, the foot and leg, nearly as high as the knee, were very much swollen and inflamed, and the skin about the instep appeared of a dark colour, and was beginning to form blisters. The tongue was of a brown colour, the pulse very quick and weak, thirst intense: in fact, the constitutional disturbance was very great. The tincture, of full strength, was immediately applied all over the foot and leg. Next day the skin of the leg was shriveled, and the limb, down to the ankle, was scarcely larger than natural. The foot, however, was still inflamed and swollen, although the pain in it—which had been before excessive—was nearly gone. The tincture was repeated, over the foot and toes. After the second application no further trouble was had with the case; the outside of the foot and sore were touched occasionally, and the latter dressed with common cerate, until it healed. The bullæ dried up, and the cuticle desquamated, leaving the surface clean and fresh.

It is remarkable in cases of this kind to find the constitutional symptoms so readily to give way as the local disease abates. Although in this case, as well as in very many analogous ones treated in a similar way, calomel and opium were administered, yet the fever and constitutional irritation abated before the mercury could have any great effect upon the system, judging from cases where the same internal remedies have been applied, and trusted to chiefly for subduing inflammation.

LACERATED, CONTUSED, AND PUNCTURED WOUNDS.

Wounds vary considerably in their nature, as well as in the degree of danger attending them. The danger depends generally much more on the part to which the violence has been done, than upon the extent or size of the wound produced by it. It not unfrequently happens that slight wounds about the head, though mere incisions, are followed by fatal erysipelas. Such effects occasionally follow the removal of tumours from the scalp: still more frequently does erysipelatous inflammation take place consequent on lacerations of that part.

Again, wounds, whether lacerated or punctured, of tendinous parts often lead to great and fatal constitutional disturbance, though very slight with regard to both depth and extent. Locked-jaw and tetanus frequently follow very trifling punctures, even when the wound itself has healed, or is apparently healing favourably. The belief has generally been that wounds followed by these effects are accompanied by a partial division of a nerve or tendon: this, however, is mere surmise, for the constitutional derangement sometimes follows where no reason exists for suspecting any such injury.

But the most common constitutional effect arising from external violence, is *fever*—that is, an acceleration of the action of the heart, accompanied with heat of skin, thirst, coated tongue, and general restlessness. These symptoms are almost always preceded by a good deal of local inflammation in the seat of injury, and the general fever is considered as "*symptomatic*" of the local disease, or as "*sympathetic*" with it, and is called so accordingly.

We have already noticed the readiness with which the general symptoms often abate as the local disease is subdued by topical remedies, and have intimated that the former are, in most instances, entirely dependent upon the local affection. We are well aware that, in broaching such an opinion, we lay ourselves open to severe criticism, as well as to misconstruction, but one must not shut his eyes against facts; nor for fear of being misunderstood or misconstrued, ought he to remain silent respecting those facts, when they relate so intimately to the treatment of disease.

Now, that local disease is frequently associated with, and occasionally dependent on, general derangement of health, no one will dispute. The history of hereditary diseases, such as scrofula, gout, &c. proves that fact. It often occurs that, previous to the appear-

ance of erysipelatous inflammation of the head, legs, or other part, the patient has for some days suffered restlessness and uneasiness, indicating the general health to be wrong ; but the appearance of the erysipelas does not mitigate the constitutional symptoms : on the contrary, the fever generally runs much higher on the breaking out of the local disease, and as the latter becomes abated, the former also will abate with it.   The instances on the other hand, of local disturbance giving rise to constitutional disturbance, are much more striking.   A person, in perfect health, receiving such local injury as to cause inflammation of a certain degree and extent, is almost sure to suffer general derangement ; and if the local affection be removed by topical remedies, the general fever will also give way without any aid from internal remedies.

A part of the body becomes " spontaneously" inflamed in a person who does not complain of any general disorder—who, in fact, has been long feeling in good health : as the inflammation extends, the general health becomes deranged, and a high degree of symptomatic fever is set up.   Had there been any previous general derangement, there must have been some symptoms to indicate it. The fact appears to be, that, in such cases, there exists in the system some morbific agent, which has no pernicious relation with the vital structure in general, but which will deleteriously associate itself with some special seat, in its passage through it in the course of circulation.   The functions of that seat are then disturbed, in consequence of the local derangement, and the system becomes secondarily affected, as it does in cases where external violence has been inflicted upon any local part.   In such instances, which, in our opinion, are the most common, the symptomatic fever will give way as the inflammation abates under local treatment, though no general remedial measures be used.

The degree of pain in a wound of the lacerated, contused, or punctured kind, is often no criterion of the amount of danger attending it ; for sometimes a whole limb is torn from the body, and yet the pain, as felt and described by the patient, is not severe.   In cases of this kind the impression upon the system is so great that the sensibility of the nerves appears to be annihilated, and death occasionally takes place before they recover their powers : at any rate, the death is not owing either to hemorrhage or to inflammation consequent on the injury, but to the general shock impressed upon the system by the magnitude of the violence.

The usual method of treating lacerated wounds, is to bring the edges gently together, or to approximate them as near as can be done without using violence, and then to retain them in that position by means of sticking plaster.   Sutures are occasionally used, when the laceration is very extensive ; but sutures should be avoided as much as possible, because they serve to add to the disturbance already caused by the solution of continuity of the living tissues, and may produce gangrene of the edges of the wound.   Having adapted the torn parts, and secured them in their position, most

practioners employ an evaporating lotion, especially that of Goulard. This remedy applies equally to lacerations and contusions. Others prefer poultices to lotions. In fact, the principle has been that of preventing inflammation as much as possible, by those remedies which come under the general term "antiphlogistics; and the object has been commonly aimed at by means of lotions in lacerations and contusions, and of poultices in punctures.

In infirmary practice, wounds of this nature, of various extent and severity, are constantly presenting themselves, and since the treatment by iodine has been adopted, little trouble, comparatively, has been had with them at the institution in this town. When the accident is one of simple laceration, as soon as the wound is well cleansed of any dirt or blood that may be adhering to it, and the bleeding guarded against, every point of its surface is touched with the tincture, generally of its full strength, and the application is extended some inches beyond its edges. Having allowed it a few minutes to dry, the edges are brought together, and there retained with sticking plaster; which completes the dressing. On the third or fourth day, according to circumstances, the plaster is removed, when, generally, the parts that had been brought into contact will be found united, and the rest of the wound will be beginning to granulate and presenting a healthy appearance. The remaining surface of the wound, and the surrounding skin, are again brushed over with the tincture, and the former dressed with common wax ointment. The same practice is repeated every day, or every other day, according to circumstances, until the wound has healed. The cure is generally—nay, almost in every instance—most rapid.

When the accident is contusion simply, the tincture is applied over the contused surface every day or two, and the part is then left without any further dressing. The extravasated blood will be absorbed in a fourth of the time that it will take to disappear under the use of a lead lotion; and we have never witnessed an instance where an unfavourable issue resulted.

When there exists a combination of laceration and contusion, the treatment is also a compound, although simple enough. The surface of the wound is brushed over with the tincture, and the same application is made to the contused skin, however extensive. The wound is then brought into approximation, and there retained by means of either a roller or sticking plaster. The remedy is re-applied according to the necessity of the case.

With regard to punctured wounds, those which have come of late years under our notice have been upon a small scale; but we conceive that all wounds of this description require the same principle of treatment. Whether a piece of iron be in the shape of a bayonet or that of a nail, will not matter much; if driven into the flesh, or into any other tissue of the body, either will inflict a punctured wound, attended by similar symptoms, and followed by similar consequences.

In several instances of the minor kinds of punctured wounds

the tincture of iodine has been used with that kind of almost un-
deviating success which it exerts over local diseases and injuries
attended by inflammation. If applied liberally, immediately after
the receipt of the injury, generally no inflammatory symptoms take
place.   If the application be commenced after inflammation has
been set up by the violence of the injury, the effect will be the
same as that attending its use in common phlegmon.   Unless sup-
puration has already begun, the malady will end in resolution after
one or two applications; and if suppuration has actually com-
menced, or if there be a disposition to sloughing, the mischief will
be confined, under the influence of the remedy, to a small compass.

In these cases, our practice has been to let the tincture insinuate
itself freely into the wound, and to apply it thickly to the skin sur-
rounding the wound : then to allow the part to remain exposed. In
trivial cases, such as the prick of a pin or needle, it is seldom that
any further notice is taken of the accident after the first application.
The injuries from nails, or other pointed pieces of iron, from the
pricks of thorns, &c., sometimes cause very severe inflammation
and constitutional disturbance; but we have found them invariably
give way to the treatment just described.

BURNS AND SCALDS.

In cases of extensive burns, life often ceases to exist before the
immediate effect of the shock on the system is thrown off.   The
injury is inflicted upon a wide-spread and important tissue, upon
which an equally important class of nerves is distributed ; and the
danger is generally dependent more upon the extent of the violence
than upon its intensity.

Three classes of remedies are used as topical applications in
burns and scalds: first, cold lotions, medicated with acetate of lead
or other materials; ice; the scrapings of potatoes, and, in fact,
every thing calculated to cool the injured part : the second consists
in the application of oil of turpentine, or of spirit of wine, as soon
as possible after the receipt of the injury; and then to dress the
part with cerates containing some of the same stimulants : the
third class comes between the other two in point of medicinal
quality ; for it consists neither in the abstraction of heat from the
part nor in stimulating it to a reaction, but in soothing it with
linseed oil, or some other oily matter.   These different remedies
have been descanted upon so frequently by surgical writers, that it
would be a waste of time for the reader to be drawn over the same
ground again.   We may state, however, in passing, that the treat-
ment with oil of turpentine, or spirit of wine, or any other spiritu-
ous liquor in the absence of these, is, according to the experience
we have had in such cases, very superior to either of the other two
plans.

Fortunately, since the tincture of iodine has been tried in burns
and scalds, we have not met with a *very severe* accident of that

description, but in four or five cases where the injury was upon a moderate scale, the remedy proved so successful as to leave scarcely a comparison between it and those commonly employed. It seems to act on burns and scalds as it does on erysipelas. When the integuments are not destroyed, although the cuticle may be in blisters, one or two applications of the tincture, of moderate strength, will subdue the pain and redness, and the case will require no further attention than to prevent the injured part from rubbing against the clothes or other things; or if on the legs or feet, to use rest until the skin has had time to recover its tone and cuticle. The remedy has been used in instances where the injury has been occasioned by fire, by boiling water, and by boiling lard, with equal success in all of them; but further trial must determine its effects in cases where the violence has been very extensively applied.

ULCERS.

Ulcers present such a variety of character as almost to defy classification; and if such an attempt were made, it would occupy a volume much larger than the present to treat of that subject alone. However, it is probable that all the varieties might be brought under two principal heads: first, ulcers dependent upon the *sloughing* of parts: second, ulcers dependent upon the *absorption* of parts. These are divisible into specific and non-specific; and each may be again sub-divided according to its external characters, or its effects on the living tissues.

Most of the specific ulcers depend on the absorption of parts: thus, we have chancre, lupus, cancer, &c. Among the non-specific, some are caused by sloughing, some by absorption, and some partly by both processes. Again, specific ulcers are almost uniform, according to their kind, in their external characters; whereas the non-specific present an endless variety in that respect. Hence, we have the clean granulating or healthy ulcer; the irritable without sloughing, with the jagged edges; the sloughing; the hospital or phagedenic; the varicose; ulcers connected with exfoliation of the bones; those caused by pressure, such as lying long in one posture, and many others, differing too minutely in their nature to come within the limit of general description.

The treatment of ulcers has been as various as ulcers themselves. Among the usual remedies, we have lotions; poultices, of bread, linseed, carrots; poultices containing beer grounds, charcoal, &c.; ointments of ever so many descriptions; fomentations: tinctures of myrrh, benzoin, &c.; nitrate of silver; sulphate of copper; diluted acids; powdered charcoal; opium; hemlock; chalk; plaster of Paris; strapping with sticking plaster; bandages; filling the ulcers with wax, and a hundred other means.

With regard to specific ulcers, they generally require (as stated in a former part of this work,) specific remedies. We have already spoken of lupus as giving way to the application of the tincture of

iodine. We have also used it in several cases of chancre, and have found the ulcer to heal much quicker than under the usual mercurial application, or the nitrate of silver. The tincture has been likewise used in ulcers of a carcinomatous character; and although we should not be justified in speaking of it in positive terms as being capable of curing cancer—certainly not cancer of the mamma —yet so many cases distinguished by scirrhous indurations, accompanied by malignant ulcerations, especially of the lips, tongue, and tonsils, have given way under its use, that, certainly, no topical remedy at present in the possession of surgery seems to equal it in efficacy in affections of that description.

It is quite evident that the first step towards the cure of a non-specific ulcer, is to render its surface clean, granulating, and healthy. The rest consists in promoting the growth of the healthy granulations. Towards accomplishing these two objects, the long list of local remedies already specified, and of a great many more, has been frequently searched, and its contents applied, in vain.

Now, when an ulcer is unhealthy; when it has a slough on its surface; or when the parts beyond its edges show a tendency to die; or when the discharge from its surface is sanious and acrid; or when its edges are jagged; or when its surface looks bloody, and the granulations, if there be any, are soft and spongy; or when it rapidly spreads, from progressive absorption—in all such cases, it is pretty clear that the vessels of the part are not in their natural and healthy condition.

The question then is, what agent is there within our knowledge, whose medicinal virtues are capable of restoring the vessels to their normal state? The question has already been answered more than once: the tincture of iodine possesses that virtue in a much higher degree than any topical remedy within our means. As we said before, we do not know *why* it should be endued with such a property—*why* it should be capable of curing so many local affections, differing so materially in their outward characters; but the *fact* is that it *is* capable of doing so, as any one may prove by putting the remedy to the trial. But, if we refer to the view taken of the nature of local disease, there seems to be nothing very *wonderful* in such a fact: the wonder would be if it were otherwise.

In all cases of sloughing, or irritable, or spreading ulcers, the tincture, of full strength, is applied freely over their surface, and to the skin, to the extent of two or three inches round them. Having been allowed to remain for some time, the ulcer is covered over with simple ointment of lint, or with a poultice, the former being generally preferred. The same application is repeated daily until the ulcer becomes clean and healthy. The tincture is then weakened, and the granulations are touched with it every two or three days. Under this plan the cavity of the ulcer fills up rapidly with healthy granulations. Where the ulcer is in a situation to have pressure applied, either a bandage or strapping with sticking plaster

is had recourse to as soon as the surface has become clean and has put on a healthy appearance.

Among several other local affections in which the tincture of iodine has been used with good effect, but whose treatment it is not necessary to follow out in detail, are gouty and rheumatic swellings of the small joints, from thickening of their ligaments: fistulous openings; malignant warts or adventitious excrescences; ganglions; the stinging of wasps; disease of the spine; ununited fractures; hernia humoralis; inflamed urethra, and chordee; inflammation of the bursæ; chronic opthalmia, and opacities of the cornea, much diluted; dissection wounds, or scratches exposed to the dead body in dissection, &c. The strength of the remedy in the several cases must depend upon the judgment of the practitioner.

It may not be amiss, in conclusion, to repeat the caution given at the commencement of this treatise, against the indiscreet employment of the tincture. If applied to a part too frequently, or too strong, it may cause the skin to inflame, and the cuticle to blister, but that is the only inconvenience which has ever occurred from its use.

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